AN OEM REFRACTOMETER FOR IN-LINE BRIX MEASUREMENT

VAISALA

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Vaisala K-PATENTS® Sanitary OEM Refractometer PR-33-AC

TYPICAL APPLICATIONS

BEVERAGES
Extraction, evaporation, brewing, distilling, blending and filling. Alcohol, rum, molasses, liquors, cider. Beer, wort, cut beer, root beer. Juices, blended vegetable juice, blended fruit juices and nectars, still drinks, vegetable and juice concentrates, ice tea, ice coffee, instant coffee, instant tea. Soft drinks, energy and sport drinks, beverage base. Wines, grape must.

CEREALS
Sugar syrup.

CONFECTIONARY
Candies, caramel, flavors, syrup, topping, sugar coating.

CULTURES, ENZYMES, YEAST

DAIRY
Condensed milk, skimmed milk, milk powder, caseinate, yeast extract, yoghurt, ice cream, whey, lactose.

EGG
Egg white, egg yolk, whole egg, mixes with added sugar or salt, egg powder.

FLAVOURS AND INGREDIENTS

FRUIT AND VEGETABLE PROCESSING
Preserves, canned fruits, canned vegetables, vegetable extract, sauces, instant soups. Soy, soy milk. Tomato based products, tomato puree, ketchup.

PRODUCT AND CIP INTERFACES
Product to product interfaces, product to CIP interfaces.

QUALITY CONTROL AND TESTING

SUGAR DISSOLVING
Standardized sugar syrup.

SOLUTION FOR OEM

We have has used our process refracto-meter expertise to develop a light, compact style refractometer model with rugged industrial durability and depend-ability. The Sanitary OEM Refractom-eter PR-33-AC is designed to meet the needs of original equipment manufac-turers (OEMs) and integrators serving beverage, dairy and food processing industries.

The Sanitary OEM Refractometer has a measurement range of 0 to 100 Brix and provides a 4–20 mA output signal proportional to the temperature compensated Brix value for real-time process control.

The Sanitay OEM Refractometer sensor is installed in the main processing line and no by-pass arrangements are required. The sensor is angle mounted in the outer corner of the pipe bend directly or through a flow cell or a Sanitary clamp. This way the best flow conditions and self-cleaning effect can be achieved. The sensor can also be mounted with a Varivent® connection.
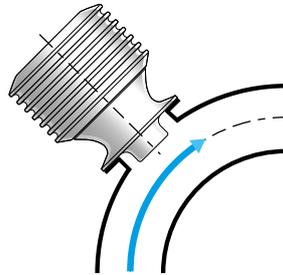
The Sanitary OEM Refractometer is Sanitary 3-A approved and EHEDG tested to meet the highest hygiene requirements of food production. It with-stands the rigors of food processing such as process temperatures up to 130°C (265°F), CIP and SIP processes and cleaning and rinsing of facilities.

The Sanitary OEM Refractometer is factory calibrated to measure Brix and temperature in standard units. Each Sanitary OEM sensor has identical cali-bration. Because of this, the Sanitary OEM sensors can be freely interchanged without optical recalibration or parameter changes. The Sanitary OEM Refracto-meter does not require any recalibration or regular maintenance.
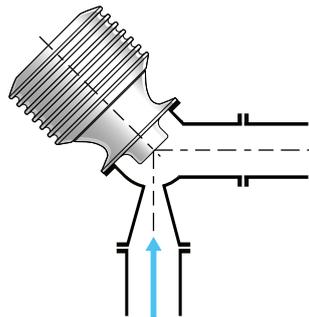
Wiring the Sanitary OEM Refractometer to a control loop is as simple as plugging a connector into the receptacle.
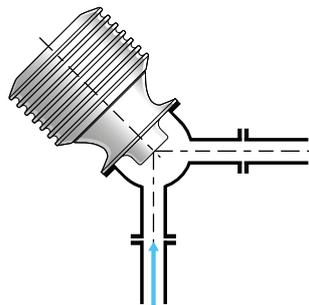
IN-LINE INSTALLATION

2.5 inch Sanitary clamp

2.5 inch Sanitary clamp and flow cell

2.5 inch Sanitary clamp and flow cell

Varivent® connection
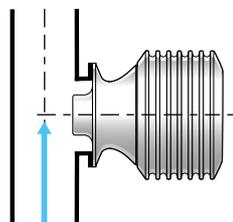
ACCURATE OPERATION

The Sanitary OEM Refractometer PR-33-AC provides truly accurate means for measuring Brix. The Sanitary OEM determines the concentration of dissolved solids by making an optical measurement of a solution's refractive index n_D. The measurement is automati-cally temperature compensated.

The measurement accuracy is n_D ±0.0002 and repeatability is n_D ±0.0001, which result in repeatability of ±0.05 Brix. The same accuracy and repeatability are provided across the full measurement range of 0–100 Brix.

The output values of the sensor are transmitted through a 4–20 mA output and an Ethernet connection by using a UDP/IP protocol.

The measurement is not influenced by bubbles, particles, sugar crystals, seeds, fibres, color or temperature and pres-sure changes in the process medium.

Our manufacturing process is ISO 9001 certified. We also support the verifica-tion within the user's own quality system. The calibration and accuracy of the Sanitary OEM Refractometer can be easily verified on-site with the certified refractive index liquids.

DIGITAL MEASUREMENT PRINCIPLE

Light source Prism Optical image

Critical angle

Process medium
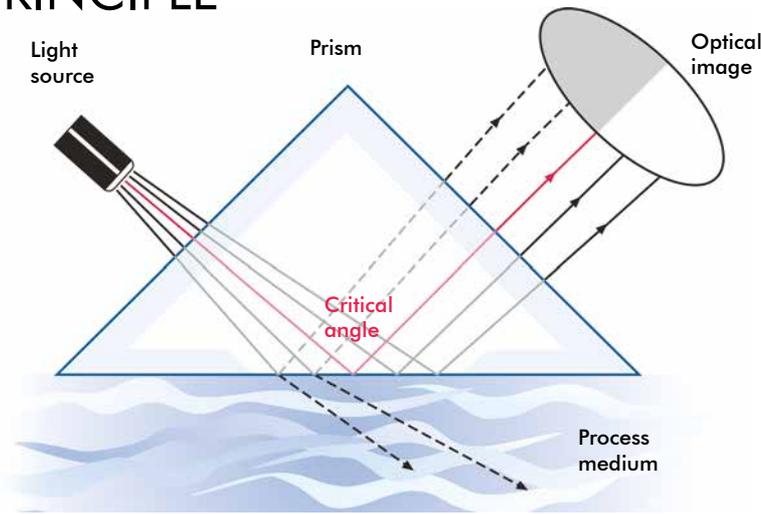
The light source sends light against the interface between a prism and the process solution, where the rays meet the surface at different angles.

Light source *Prism* *Reflected light*

Solution *Refracted light*

Depending on the angle, some rays undergo a total internal reflection. The rest of the light is refracted into the process solution.
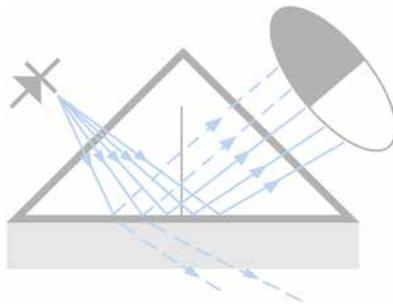
Thus an optical image with a dark sector and a light sector is created.

The angle corresponding to the shadow line is called the critical angle of total internal reflection. This angle is a function of the refractive index and therefore the concentration of the solution.

Critical angle

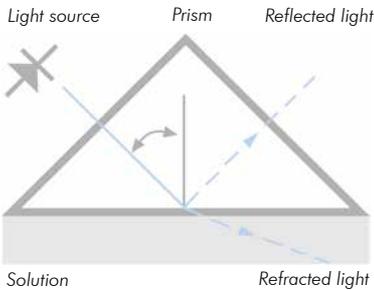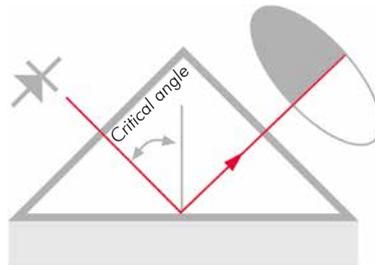A CCD-camera detects the optical image. The image is transformed point-by-point into a digital signal. Digital signal processing is used to locate the exact shadow line position and to determine the refractive index n_D.

A built-in temperature sensor measures the temperature T on the interface of the process liquid. The sensor converts the refractive index n_D and temperature T to Brix units.

The diagnostics program ensures that the measurement is reliable.

DATA LOGGING VIA ETHERNET

The Sanitary OEM Refractometer PR-33-AC is the most advanced refractometer on the market since it includes an Ethernet based communications solution. This allows connection and data download to a computer. Real-time measurement data and diagnostic information may be obtained through this interface, and this makes it also a valuable service tool for parameter changes and software updates.

Any computer with a standard Ethernet connection can be configured to view and download data from the sensor by using a standard web browser.

DESIGN

Air cooling fins

Processor card

Thermal conductor

Thermal isolation

Light source

Modified
PTFE
Prism
gasket

CCD-camera

CORE-Optics

Prism

Temperature
sensor
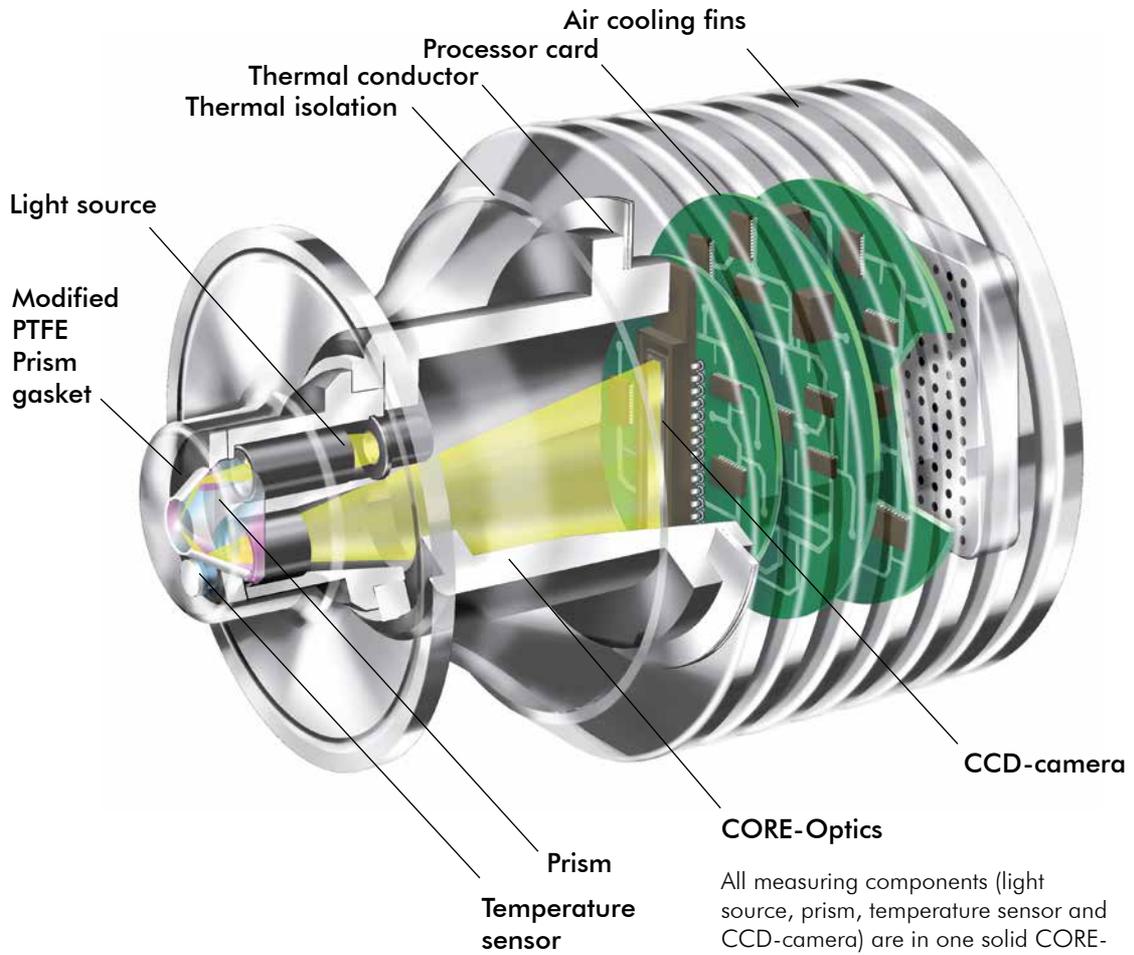
All measuring components (light
source, prism, temperature sensor and
CCD-camera) are in one solid CORE-
optics module.

The CORE-optics is mechanically
isolated from the influence of external
forces and vibrations. The CORE-optics
contains no mechanical adjustments.

SPECIFICATIONS

Sensor PR-33-AC with 2.5 inch Sanitary clamp

EFC Flow cell, 2.5 inch line diam.

AFC Flow cell, 2 inch line diam., straight inlet

AFC Flow cell, 1 inch line diam., reduced inlet

Refractive Index range:	Full range 0..100 Brix, corresponds to $n_D = 1.3200...1.5300$
Accuracy (across the full range):	± 0.1 Brix, corresponds to Refractive index $n_D \pm 0.0002$ Repeatability ± 0.05 Brix, corresponds to $n_D \pm 0.0001$
Speed of response:	1 s undamped, damping time selectable up to 5 min
Calibration:	With Cargille standard R.I. liquids over full range of n_D 1.3200...1.5300
CORE-Optics:	No mechanical adjustments (US Patent No. US6067151)
Digital measurement:	3648 pixel CCD element
Light source:	Light emitting diode (LED), 590 nm wavelength, sodium D-line
Temperature sensor:	Built-in Pt1000, linearization according to IEC 751
Temperature compensation:	Automatic, digital compensation
Instrument verification:	According to ISO 9000 quality system: with Cargille standard R.I. liquids and guided procedure over Ethernet
Ambient temperature:	Max. 45°C (113°F), min. -20°C (-4°F)
SENSOR PR-33-AC:	
Process connection:	Sanitary 3A-clamp 2.5"; Varivent® in-line access unit clamp DN65 or via elbow flow cell (for line sizes of 2.5" and smaller)
Process pressure:	Max. 15 bar (200 psi) at 20°C (70°F)/9 bar (125 psi) at 120°C (250°F)
Process temperature:	-40°C...130°C (-40°F...266°F)
Process wetted parts:	Stainless steel 1.4435 (AISI 316L), (Ra<0.8μm, 30 μ inch), prism sapphire, prism gaskets modified PTFE (teflon)
Sensor housing material:	AISI 304 stainless steel
Sensor protection class:	IP67, Nema 4X
Sensor weight:	1.7 kg (3.7 lbs)
Fieldbus and industrial Ethernet connectivity	Through Fieldbus converter to Modbus/TCP, Modbus RTU and Ethernet/ IP networks
Current output:	Isolated 4–20 mA (1000 Vdc isolation voltage)
Ethernet output:	10/100BaseT Ethernet, web server for configuration and diagnostics, UDP/ IP connection for data aquisition
Power supply:	+24V, less than 2 W
INTERCONNECTING CABLES:	optional
Electrical cable:	PR-8350-010, four-wire cable for +24V power supply and mA output. Cable connector: C-coded male M12 connector on the cable
Ethernet cable:	PR-8330-010, standard industrial Ethernet cable. Cable with RJ45 connector and M12 4-pin D-coded male (female at device) for Ethernet. Cable with M12 4-pin A-coded female (male at device) for +24VDC and mA
Interconnecting cable length:	10 m (33 ft)
OPTIONS:	Interconnecting cables, flow cells, blind flange for Sanitary clamp 2.5 inch

ORDERING INFORMATION:
- Sensor type and process connection
- Desired scale
- Properties of process solution
- Process temperature range
- Process pipe size
- Process flow rate
- Options and accessories

We reserve the right to technical alterations.