

Sugar Industry

Sugar Facts:

- Worldwide 170 million tons of raw sugar have been produced in 2011/2012

- Brazil, India, China & EU are the most important sugar producing nations

- With an annual consumption of more than 24 million tons India, is the world's largest market for raw sugar

Country	2010/11	2011/12
Brazil	38,350	35,750
India	26,650	28,300
European Union	15,090	16,740
China	11,199	11,840
Thailand	9,663	10,170
United States	7,110	7,153
Mexico	5,495	5,650
Russia	2,996	4,800
Pakistan	3,920	4,220
Australia	3,700	4,150
Other	37,264	39,474
Total	161,437	168,247

World sugar production (1.000 metric tons)

Discussed in this edition:

The sugar market worldwide	1
Raw materials & processing	1
Storage & logistics	1
Why the need to measure humidity?	2
Which solution can Rotronic offer?	2
Rotronic products	3
Contact us	4

The sugar market worldwide

Sugar is one of the most important raw materials traded on the worldwide markets.

Whereas in the 18th century only few countries were producing sugar, these days over 100 nations process different base materials into sucrose. Remarkably India, China, Brazil & the European Union alone deliver 50% of the global demand.

Raw materials & processing

In temperate regions such as West, Central & Eastern Europe, the United States, China and Japan raw sugar is produced from sugar beet.



Sugar Cane

Sugar beet

However in the tropics and subtropics sugar is extracted from sugar cane.

Processing

The processing of those two raw materials only differs in the first few steps.



The main goal is to extract the juice, where sugar is contained, from the beet or sugar cane as efficiently as possible.

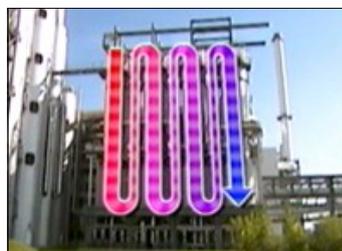
Extracting the sugar

Sugar cane is cut into small pieces during the harvest before it runs through an industrial press to squeeze out the sweet sap.

Sugar beet has to be processed in extraction towers, where the plants release their sugar during a hot water treatment at 70°C.

Evaporation

After filtering the juice the water is extracted by passing through different stages of evaporators until only a thick syrup is left consisting of around 70% sugar.



Evaporators

Crystallisation

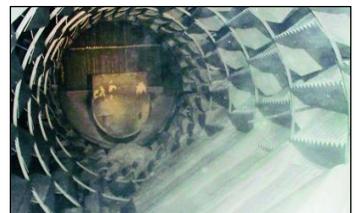
The syrup is then boiled until sugar crystals are formed.

These crystals are then cleaned through centrifugation.

To reach an even higher purity this process will be repeated twice.

Cooling & drying

Now the sugar has to be dried. One option is in large scale drum dryers at a temperature of 60°C.



Inside a drum dryer

Right after, the sugar is cooled down on fluidized-bed coolers before heading to the warehouse or packed for shipping.

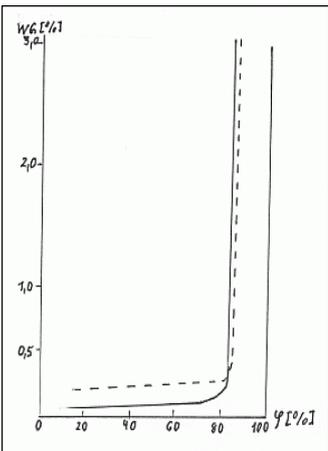
Storage & logistics

Sugar belongs to the group of hygroscopic goods with an extremely low water content below 1.5%. Basically sugar is a robust material but vulnerable to high humidity and temperature changes.

Generally it is recommended to store and transport sugar at

a temperature of 20-25°C and 25-60% relative humidity.

By taking a closer look at the adsorption curve of sugar it is easy to see that over a long range of relative humidity the product quality is not affected. But as soon as the humidity level rises to 75% sugar starts to clump and above 80% relative humidity even dissolves.



Adsorption curve of sugar at 10 & 20 °C
X: relative humidity Y: Water content

Storage

Right after the production the refined sugar is stocked unpacked in humidity controlled sugar terminals or ventilated silos connected to dehumidifiers.

Logistics

Large quantities are transported in silo trucks or train wagons. When sent by ship sugar is packed in double-walled bags made of natural fibre and plastic.

If sealed like this, temperature is the crucial parameter which can affect the quality of the sugar. Due to big differences in temperature water vapour left inside the bags may cause clumping and even liquefaction.

The finer the sugar, the higher the risk of clumping.



Sugar terminal in Australia

Top 5 sugar producing companies

1. Suedzucker AG,
2. Cosan SA Industria & Comercio
3. British Sugar PLC
4. Tereos Internacional SA
5. Mitr Phol Sugar Corp.

Source: Bloomberg.com

Why the need to measure humidity?

As seen above, temperature and humidity measurements are crucial parameters in the sugar industry. Due to its hygroscopic behaviour sugar can resist small changes in humidity and slight temperature variations are not a major problem. But as soon as relative humidity rises above 80% or temperature changes significantly, the product can be destroyed as it clumps or even turns liquid.

During the process of evaporation, crystallisation, drying and cooling temperature and humidity play a huge role.



Evaporation towers

What solution can Rotronic offer?

Rotronic offers various solutions for the different sectors of the sugar industry from the production all the way to warehouse and transport applications.

HF7 industrial transmitters deliver signals to control the final stage of evaporation systems, the climate inside of drum-

dryers. To adjust the HVAC systems **HF5** is just the right choice.

EX-proof transmitters as the **HTS3** and the **HC-IC-1-EX** probes can be used to control dehumidifiers of the sugar silos.

Loggers such as the the FDA compliant **HL-NT** or the **HL-20** document

the climate in the factories and warehouses.

Rotronic wireless loggers like the **Log-HC2-RC** monitor the climate during transportation & easily can be read out on the final destination for quality documentation.



LOG-HC2-RC

HF7 transmitter

Rotronic products:

Humidity and temperature probes:

- HC2-S**
 Standard humidity sensor,
 -50...100°C,
 0...100%rh,
 ±0.8%rh and ±0.1K...
- HC2-IM**
 Chrome nickel steel Industrial probe,
 -100...200°C,
 0...100%rh,
 ±0.8%rh and ±0.1K...
- Hygroclip IC-1-EX**
 ATEX & FM approved probe,
 -50...200°C,
 0...100%rh,
 ± 1 %rh and ± 0.3K

Transmitters:

- HF5 series**
 For interchangeable probes,
 2 or 3/4 wire configuration,
 Various analogue and digital outputs,
 Display,
 All psychrometric calculations available...
- HF7 series**
 Stainless steel probe,
 -100...200°C,
 3/4 wire configuration,
 Various analogue outputs,
 Display...
- HTS3**
 Compatible to all HygroClip-EX probes,
 3 line LCD
 RS-232 interface
 Conforms to 21 CFR Part 11
 and GAMP5, 3 analog outputs

Dataloggers:

- HL-NT range**
 For interchangeable probes
 (up to 7 probes with docking station)
 32MB flash card,
 Display,
 Conform to FDA21 CFR Part 11
 and GAMP4...
- HL-20**
 20'000 measurement pairs,
 Display,
 ±0.8%rh and ±0.2K,
 Conform to FDA21 CFR Part 11
 and GAMP4...
- LOG-HC2-RC**
 Wireless data logger compatible to HC2-S(3)
 Saves up to 500.000 measured values
 Application range: -40 to +85°C



HL-NT datalogger



HL-20 data logger



HygroClip IC-1-EX



HTS3 transmitter for IE/EX probes



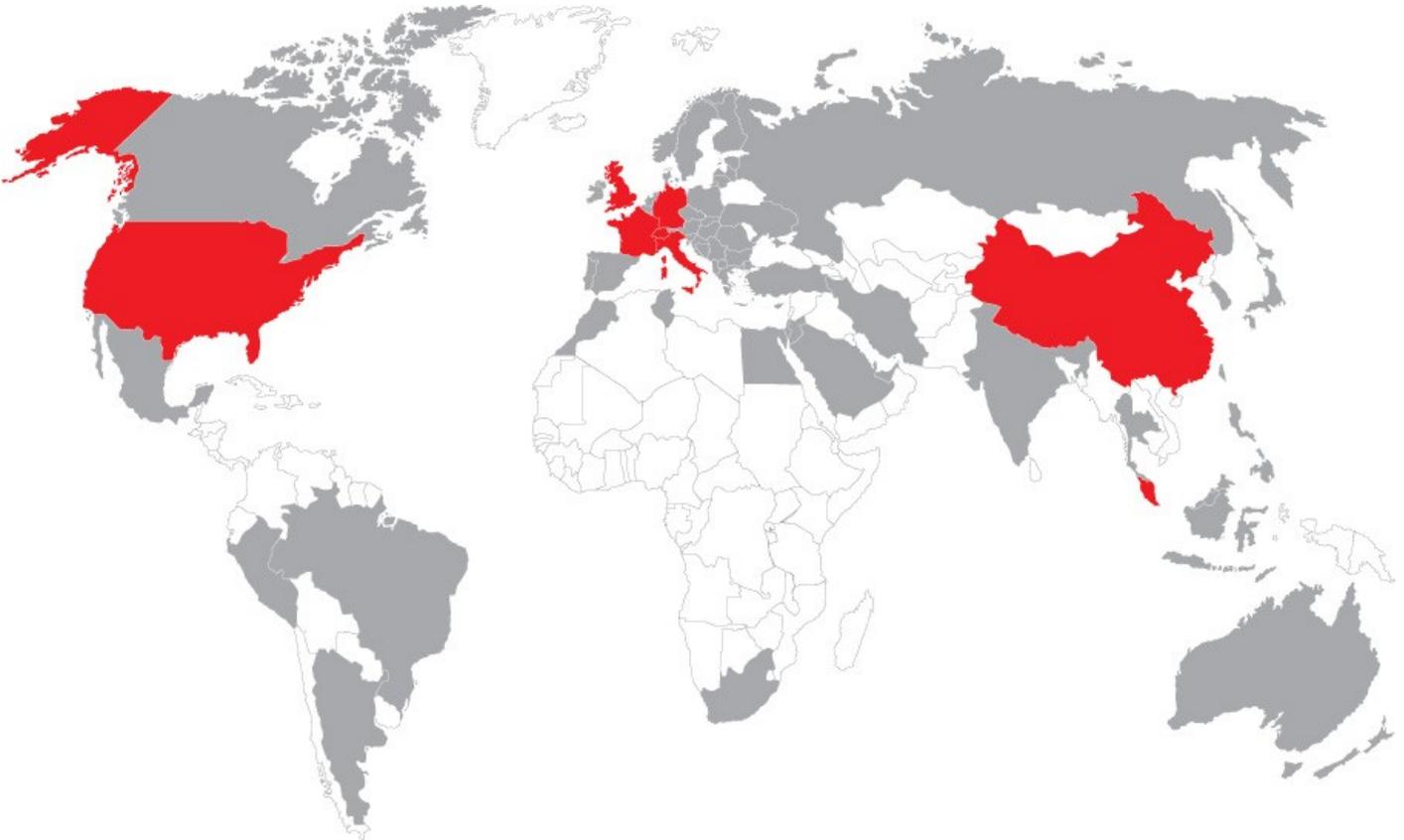
HF5 transmitter with a HC2-S probe

Zone 0/20 T5	Zone 1/21 T6	Zone 1/21 T6	Safe zone Zener barrier or galvanic isolation
Class II, Division1 Group E, F, G		Class I, Division1 Group A, B, C, D	
		HygroClip IC-1-EX Ⓢ II 1 G EEx ia IIC T5 resp. II 2 G EEx ia IC T6 Ⓢ II 1/2 D IP6X T 80 °C	

Typical ATEX installation

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