YUTECH FLUID-DENSITY-BRIX ANALYZER CUM CONTROL SYSTEM AND MOTORIZED FLUID-DENSITY SENSOR

BASED ON YUTECH'S A15 INTELLIGENT ANALYZERS AND SYSTEMS PLATFORM

YUTECH SINCE 1978

BASIC SCIENCE BEHIND FLUID-DENSITY-BRIX:

- **Fluid-Density:** the Density of a particular Fluid.
- **Density:** is defined as "**Mass per unit volume**", which means it is the Mass contained in a fixed volume. It is denoted by "**ρ**" which is a Greek Letter called "Rho".
- **Density** can be derived using the formula "**ρ = m/v**" where ρ is the Fluid-Density, m is the Mass and V is Volume. The unit to measure Fluid-Density is **kg/m³** (Kilogram per cubic meter).
- **Brix:** the measurement in percentage by weight of sucrose in pure water solution.
- Online Direct measurement of Brix in a Process Fluid is difficult, so indirect methods are used.
- **The most popular ways of measuring Brix are:**
  - **Hygrometric and Refractometric (Lab Methods)**
  - **High-Frequency or Radio-Frequency Conductivity type Brix Sensing**
  - **Microwave Type Brix Sensing**
  - **Fluid-Density Type Brix Sensing is the latest technology assisted by complex mathematical equations and linearization formulae.**
- While Conductivity or Microwave methods are very successful in measuring Brix of "B and C" Massecuite in CVP, Brix of Sugar Melt, and Brix in a Molasses Conditioner unit, they cannot measure Brix of "A" Massecuite as we measure the Fluid's electrical quality which is variable.
- Fluid-Density Measurement using a Motorized Stirring Sensor proves very successful as it directly measures the Fluid's mechanical quality irrespective of its electrical characteristics. Thus, measured Fluid-Density Value is further processed in the **Fluid-Density-Brix Equation,** to derive **Fluid-Density-Brix.**

APPLICATION IN SUGAR PROCESS OR SUGAR REFINERY:

For Measuring FLUID-DENSITY-BRIX of Massecuite / Syrup / Melt / Liquor / Magma / Seed in:

- Vertical Continuous Vacuum Pan (VCVP or VKT) Chambers
- Batch Type Vacuum Pans and Continuous Vacuum Pans
- Sugar Melters and Molasses Conditioners
- Evaporators
- Open Pans in Khandsaris or Mini Sugar Plants / Jaggery or Muscovado Plants
- Boiling Vessels in Jaggery or Muscovado Production

FLUID-DENSITY MEASUREMENT APPLICATION IN OTHER PROCESS INDUSTRIES:

- **FOOD & BEVERAGES:** In Vessels or Pans for Monitoring the Consistency of Sauces / Slurries / Pastes etc.
- **CHEMICAL / PHARMA:** In Thickening / Thinning Vessels or Pans for Monitoring the Consistency of Chemical Slurries / Pastes
- **DISTILLERIES:** In Fermentation / Maturation Vessels and Spent-Wash Evaporators for Monitoring Brix
- **BREWERIES:** In Fermentation Vessels for Monitoring Brix Fermentation Vessels, Maturation Tanks

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SALIENT FEATURES:

- Fluid-Density Type Brix Analyzer System targets sensing the Fluid-Density of Liquids, Slurries, or Syrups like Sugar Massecuite, Sugar Syrup, Sugar Melt, Liquors, and Molasses.
- The Motorized Fluid-Density Sensor is specially designed to be inserted in a vessel to stir the Fluid Media and Measure its Fluid-Density, which can be expressed in simple terms as the Tightness or Thinness of a Fluid Media. It can also be informally referred to as the Consistency of the Fluid and is a Mechanical Property of a Fluid, which in Liquids is directly proportional to its Viscosity.
- The Motorized Sensor's torque and power required to stir the Fluid varies with varying Fluid-Density.
- Thus, the Motorized Fluid-Density Sensor's Power Consumption is directly proportional to the Fluid's Density.
- The Fluid-Density-Brix Analyzer's highly accurate Sensing Circuitry senses variation in the Motorized Fluid-Density Sensor's Power Consumption. This deviation is further processed to Derive the Raw Fluid-Density Value.
- The Raw Fluid-Density Value is Linearized in the YUTECH Fluid-Density-Brix Equation.
- The **YUTECH** Fluid-Density-Brix Equation is a complex Mathematical Algorithm with Built-in Fuzzy Logic that Accurately Analyzes, Calculates, and Derives the Fluid-Density-Brix Value from the Raw Fluid-Density Value.
- This derived Fluid-Density-Brix Value is further analyzed and processed to compensate for Massecuite / Syrup Level variation within the Vessel.
- Fully Compensated and Accurate Fluid-Density-Brix Value is Displayed and Transmitted for Controls.
- Very Easy Calibration and Online Fluid-Density-Brix Compensation Recalibration
- 4-20 mA Output, Separate Modbus and Ethernet Communications.
- On-line Calibration Software "YUTECH-AccessApp" provides Remote Access to Density-Brix Analyzer for Calibration, Compensation, and Trouble Shooting.

Innovative Features for Ease of Operation and to save on Installation Cost and Materials:

- **Built-in Fluid-Density-Brix Equation**
- **Built-in Level Compensation**
- **Built-in PID Controller with specialized logic built with years of experience in over 200 Sugar Factories:**
  - Highly Accurate Fuzzy Logic PID Controller developed especially for Process Flow Control Applications.
  - Pan Control Logic built especially for Batch type Vacuum Pan Operations
  - VC Pan Chamber Control Logic built especially for Vertical Continuous Pan Operations
  - CVP Pan Chamber Control Logic built especially for Continuous Vacuum Pan Operations
  - Special Control Logic built for Sugar Melter and Molasses Conditioner
  - Remote Set Variable Facility

- **Built-in 3-Point Auto/Manual Station to Select Control Output from:**
  - Selector Switch for Local PID Output or DCS/PLC PID Output
  - Manual Output for Trouble Shooting

  This feature simplifies installation by eliminating the need for installing a Junction Box and Extra wiring.

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TECHNICAL SPECIFICATIONS – ANALYZER CUM CONTROL SYSTEM:

- Power Supply: 85 - 265 VAC, 50 – 60Hz
- Analyzer Enclosure: IP67 Field Mounted Dust and Moisture Proof
- Input:
  - Fluid-Density Sensor Signal
  - RTD PT 100 Temperature Sensor Signal
  - DPT Level Transmitter Signal
  - VFD RPM Signal (Optional)
  - Conductivity 8-Level Sensor Signal
- Calibration:
  - From Keyboard
  - USB Port for Windows / Android-based YUTECH-AccessApp-BA
- Display:
  - Base Model: 4 Digit LED Dual Display
  - Controller and Controller with Ethernet Model: 4 Digit LED Quad Display
  - Sensor Cleaning and Washing Output: In-Built Potential Free Relay
- Sensor Cleaning Timing Cycle: Adjustable from Keyboard, default 15 Minutes
- Signal Output:
  - 4 - 20 mA Temperature Compensated Fluid-Density-Brix Output
  - 4 - 20 mA PID Output (Controller and, Controller with Ethernet Models)
  - 2 Potential-Free Relay Outputs for High – Low Alarm
- Communications:
  - Ethernet Communication Protocol: Modbus-TCPIP, in Controller with Ethernet Model
  - Modbus RTU, in Controller Model

MOTORIZED FLUID-DENSITY SENSOR (PRODUCT CODE: ASDMFDS24DCC01):

- Motorized Circulator or Stirrer stirs the Fluid whose Fluid Density is to be measured.
- Power consumed
- MOC: Wetted parts: Stainless Steel (SS316) / PTFE. Non-wetted parts: SS / MS / Aluminium / PTFE.
- MOC: All SS and Food Grade PTFE Construction optional.
- MOC: Wash Water Spray Tube: SS.
- Solenoid Valve for Automatic Sensor Wash
- Sensor Shaft is sheathed in Leak Proof Mechanism.
- Periodic Cleaning by a signal from the Fluid Consistency Brix Analyzer.
- 24VDC Power Supply.

TEMPERATURE SENSOR:

- RTD PT 100 Temperature Sensor with Thermowell constructed out of Solid SS Bar.

LEVEL SENSORS:

- DPT with Extended Diaphragm and Capillary Type Sensing (Optional)
- 8-Level Conductivity Sensing (Standard)
  - MOC: Stainless Steel (SS316) / PTFE.

Product Code:

- A15FDAACSCTRC1D4R4FM – A15FDA means Fluid-Density Analyzer of A15 Product Family
- A15FDAACSCTRC1D4R4FM – AC Power Supply
- A15FDAACSCTRC1D4R4FM – Analog Inputs and Outputs
  - AI (CSCTR): Fluid-Density Sensor, 8 Step Level and RTD PT100, Optional: 4-20mA from DPT Type LT;
  - AO (C1): 1 Ch. 4-20mA (Brix); AO (C2): 2 Ch. 4-20mA (Ch. 1: Brix and Ch. 2: PID)
- A15FDAACSCTRC1D4R4FM: Digital Inputs and Outputs
  - DI (D4): 4 DIs (24VDC); DO (R4): 4 Relay Outputs (24VDC, 1A)
- A15FDAACSCTRC1D4R4FM – Field Mounted Enclosure
- A15FDAACSCTRC2D4R4FMC – Analyzer with Controller Model
- A15FDAACSCTRC2D4R4FMCEM – Analyzer with Controller and Ethernet Model, EM: Modbus TCP/IP Communication (Ethernet)

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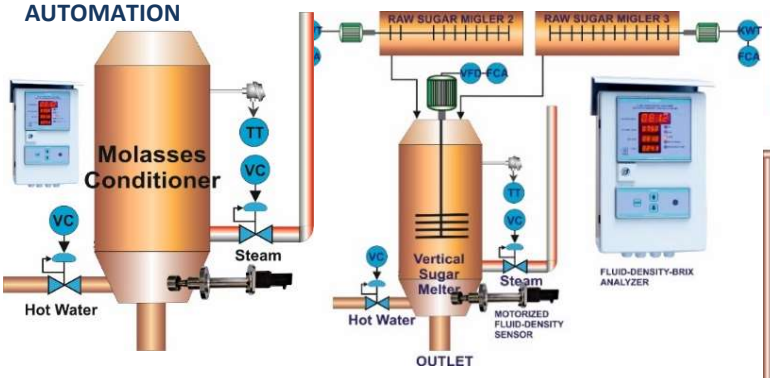
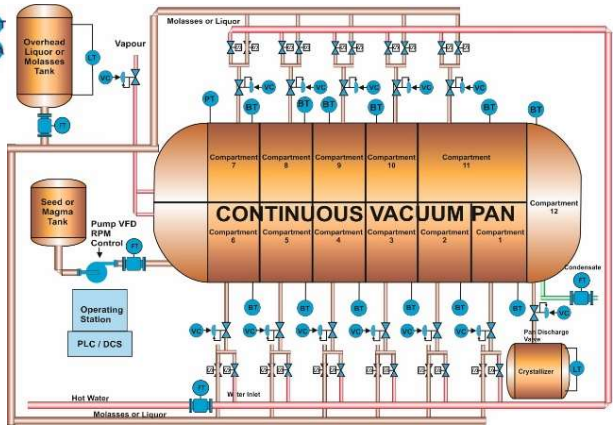
SCHEMATIC DIAGRAMS & SCREENSHOTS OF SYSTEMS USING FLUID-DENSITY-BRIX ANALYZER

SCHEMATIC: SUGAR MELTER AND MOLASSES CONDITIONER AUTOMATION

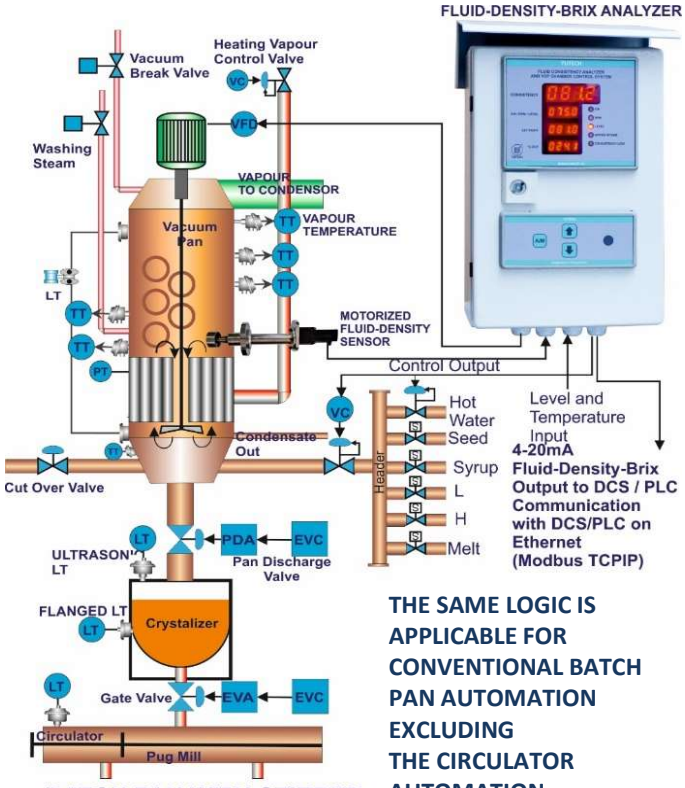


SCHEMATIC: CV PAN AUTOMATION



SCREENSHOT: BATCH PAN AUTOMATION

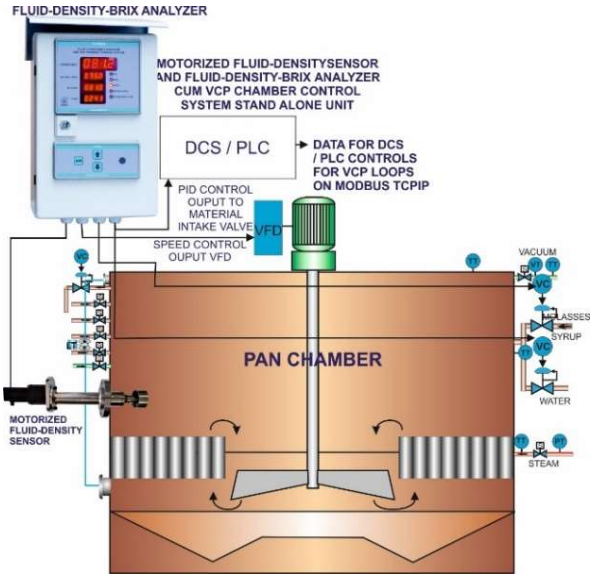
SCHEMATIC: BATCH PAN AUTOMATION

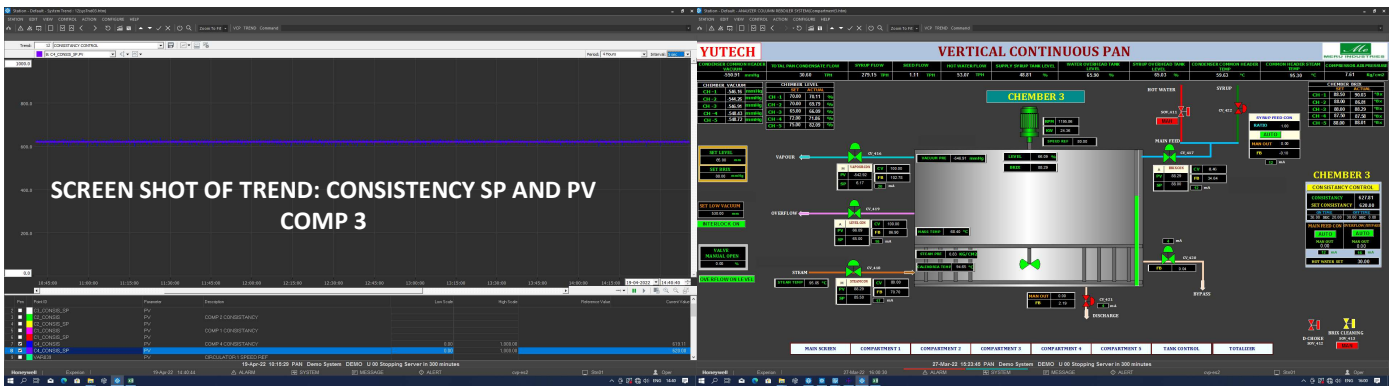


BATCH PAN WITH STIRRER

THE SAME LOGIC IS APPLICABLE FOR CONVENTIONAL BATCH PAN AUTOMATION EXCLUDING THE CIRCULATOR AUTOMATION

VERTICAL CONTINUOUS PAN CHAMBER AUTOMATION





FOR MORE DETAILS, PLEASE SEE THE PRESENTATION ON OUR WEBSITE www.yutechautomation.com.

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