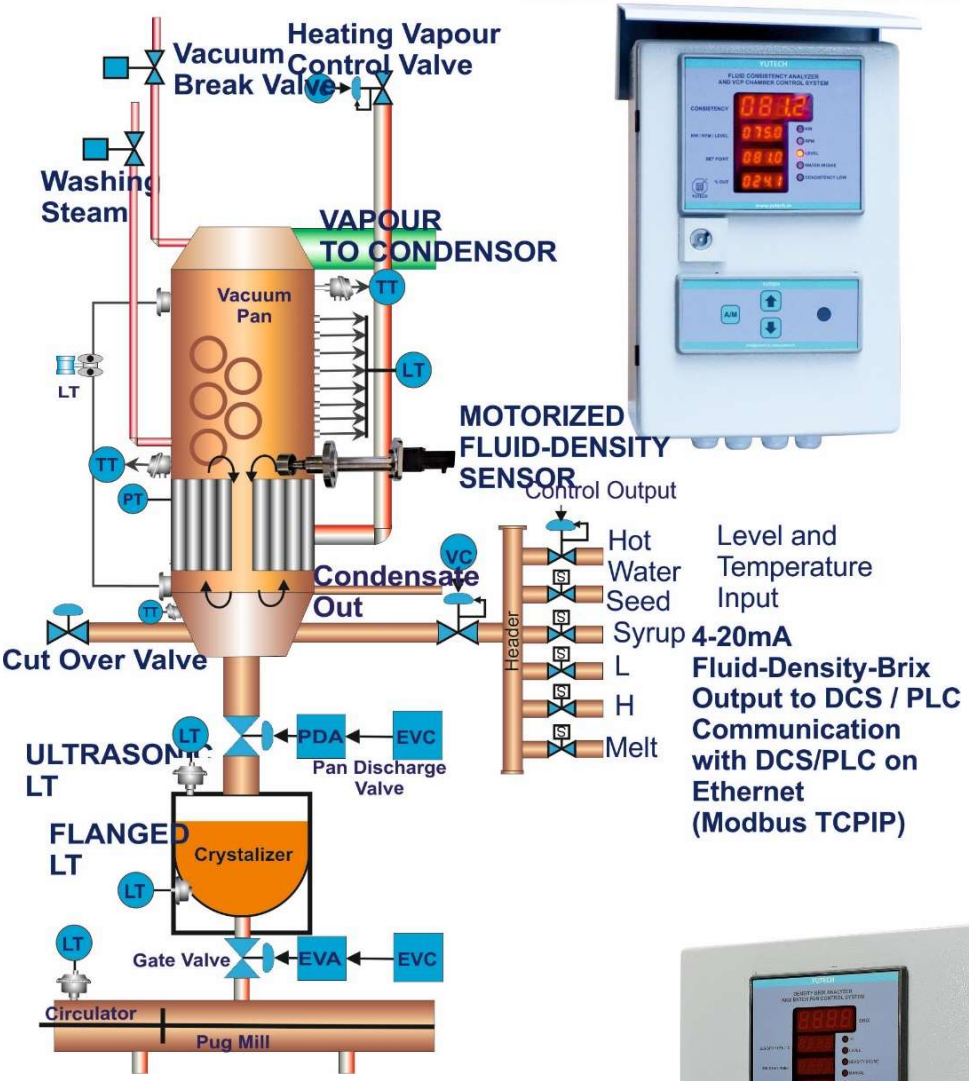
BATCH VACUUM PAN AUTOMATION WITH BRIX ANALYZER AND DENSITY BRIX SENSOR

GUARANTEED INCREASED PROFITS, INCREASED PAN STRIKES, AND SUGAR PRODUCTION IN LESS TIME

YUTECH SINCE 1978

BATCH PAN AUTOMATION WITHOUT MECHANICAL CIRCULATOR:

FLUID-DENSITY-BRIX ANALYZER



ACCURATE BRIX MEASUREMENT THROUGHOUT THE PAN STRIKE WITH BRIX ANALYZER AND FLUID DENSITY SENSOR

GUARANTEED
INCREASED PROFITS
INCREASED PAN STRIKES
INCREASED SUGAR PRODUCTION
NO FALSE GRAINS

BRIX ANALYZER AND FLUID-DENSITY SENSOR

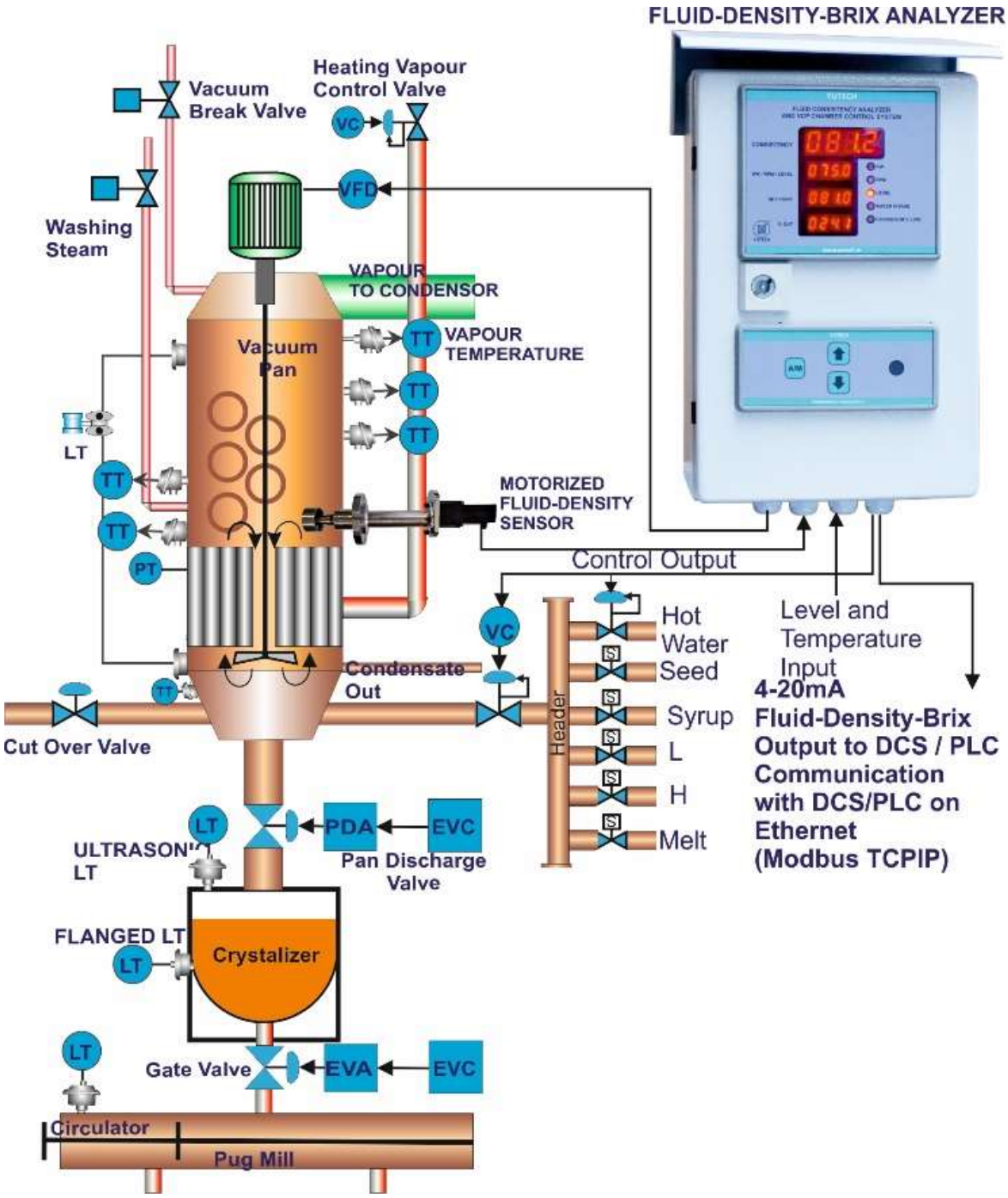
BRIX, AND FLUID DENSITY IN KG/M^3, WITH LEVEL, TEMPERATURE, AND VACUUM COMPENSATION

SHARE YOUR BATCH PAN DETAILS AND REQUEST RETURN ON INVESTMENT CALCULATION

www.yutechautomation.com; www.yutech.in; sale@yutech.in

YUTECH SINCE 1978

BATCH PAN AUTOMATION
WITH MECHANICAL CIRCULATOR (STIRRER)



ACCURATE BRIX MEASUREMENT THROUGHOUT THE PAN STRIKE WITH BRIX ANALYZER AND FLUID DENSITY SENSOR

WE UNDERTAKE MECHANICAL CIRCULATOR INSTALLATIONS

BATCH PAN AUTOMATION
BENEFITS

TECHNICAL BENEFITS:

- ACCURATE BRIX SENSING AND CONTROL AIDS IN CONTROLLED SUPER-SATURATION OF MASSECUITE
- EXCELLENT CONTROL THROUGHOUT THE CONCENTRATION, GRAINING, BUILD-UP AND TIGHTENING, AND THE LAST STAGES OF EACH PAN STRIKE
- THE AUTOMATION SYSTEM CREATES NEAR IDEAL BOILING CONDITIONS IN THE PAN BODY IN TERMS OF BRIX, VACUUM, TEMPERATURE AND LEVEL, AND THIS HELPS TO REGULATE THE PAN BOILING PROCESS AS BELOW:
    - VACUUM AND TEMPERATURE SYNCHRONIZATION IS ACHIEVED AS PER THE VACUUM TABLE THROUGHOUT THE STRIKE TIME (IN FULL PAN AUTOMATION)
    - HIGHLY ACCURATE BRIX SENSING BY FLUID-DENSITY-BRIX ANALYZER AND SENSOR
    - SUPER-SATURATION IS ACCURATELY CONTROLLED BY REGULATING INTAKE OF MATERIAL TO MAINTAIN THE BRIX AT PRESET VALUES IN ALL STAGES OF THE STRIKE
    - MECHANICAL CIRCULATOR IS AUTOMATICALLY STARTED WITH SPEED CONTROL CORRESPONDING TO LEVEL AND TEMPERATURE TO FORCEFULLY FACILITATE MASSECUITE MOVEMENT AND ENSURE ORIGINAL GRAIN PROTECTION FROM DISSOLUTION ESPECIALLY DURING THE FINAL STAGE
    - AUTOMATIC / SEMI-AUTOMATIC SLURRY CHARGE SYSTEM AT THE PRESET BRIX VALUE, AFTER LEVEL REDUCES DUE TO EVAPORATION TO START GRAINING STAGE WITH PROMPTING MECHANISM TO ALERT THE PAN-MAN
    - AUTOMATICALLY CONTROLLED INTAKE OF MOVEMENT WATER TO MAINTAIN BRIX TILL THE GRAIN IS STABILIZED WITH PROMPTING MECHANISM TO ALERT THE PAN-MAN
    - AUTOMATIC INTAKE OF MATERIAL AFTER GRAIN IS STABILIZED TO START THE BUILD-UP AND TIGHTENING STAGE WITH PROGRESSIVE PRESET BRIX SET POINTS FOR EACH LEVEL TILL FULL PAN LEVEL
    - ACCURATE CONTROL DURING THE LAST STAGE OF THE STRIKE ALLOWS MOVEMENT WATER INTAKE ONLY, IF NECESSARY, WITH A PROMPTING MECHANISM TO ALERT THE PAN-MAN
        - THUS, NO EXCESSIVE SUPER SATURATION
            - HENCE NO SECOND OR FALSE GRAIN FORMATION
            - THUS, EXCESS WATER ADDITION TO DISSOLVE FALSE GRAIN OR FOR MASSECUITE MOVEMENT IS AVOIDED
                - **INCREASED SUGAR PRODUCTION**
                - **WATER SAVING**
                - **STEAM / VAPOUR SAVING**
                - **HIGHER PRODUCTION AND RECOVERY**
                - **UNIFORM ORIGINAL GRAIN SIZE WITHOUT SECOND GRAIN**
                - **LESSER STRIKE TIME**

COMMERCIAL BENEFITS OF YUTECH BATCH PAN AUTOMATION:

- GET INCREASED PRODUCTION IN SAME TIME WITH BETTER RECOVERY AND NO REWORK WASTAGE
- OR GET REDUCTION IN STRIKE TIME BY 10 TO 15%, THUS INCREASE IN NUMBER OF PAN STRIKES
- HUGE STEAM AND WATER SAVING IN REGULAR PRODUCTION
- EXCELLENT SUGAR COLOUR AND QUALITY WITH UNIFORM GRAIN SIZE
- REDUCED COSTS IN TERMS OF TIME AND RESOURCES WASTED IN RE-MELTING AND RE-BOILING
- MAXIMIZED CAPACITY UTILIZATION IN PANS AND CENTRIFUGAL MACHINES
- BETTER PURGING AND LOWER LOADS ON CENTRIFUGAL MACHINES
- INCREASED PROFITABILITY

PLEASE CHECK THE PAN AUTOMATION ECONOMIC SHEET ON PAGE 6 OF THIS DOCUMENT

BATCH PAN AUTOMATION
ADVANTAGES

ADVANTAGES OF YUTECH SENSING AND CONTROLS:

- Pan Boiling accounts for roughly 30-40% of the Sugar Manufacturing Process / Boiling House Energy needs.

- **YUTECH Batch Pan Automation** saves a huge amount of Energy in terms of Steam / Vapour. This can be Quantified by Steam and Vapour Condensate Flow Measurement.

- Conventional Pan Boiling is too dependent on Pan-man, over the years Pan Boiling has come to be known more as an Art than Science and this very Art is being lost.

- **Correct Brix Sensing, Co-ordinated Level, Temperature, and Vacuum Controls assist in Creating Excellent Pan Boiling Conditions**.

- The Brix Reading is always a very big point of contention between the Pan-man and the Chemist. **YUTECH Fluid-Density-Brix Analyzers** solve this problem by giving true Brix Readings in all Massecuites / Syrups at all given times, thus **YUTECH Batch Pan Control Algorithm** creates **Excellent Pan Boiling Conditions.**

- Human Attention Span has its limitations, and the Pan Operator cannot always be fully attentive, this sometimes results in Over-Thickening of the Massecuite leading to Water Addition for Dilution. Water Addition when done other than in the Grain Stabilization Stage and the Final Stage (if required) is an **UNACCOUNTED AND PURE WASTAGE OF WATER AND HEATING STEAM**.

- **YUTECH Fluid-Density-Brix Analyzers** and **YUTECH Batch Pan Control Algorithm together address this issue AND EFFECT HUGE TIME, WATER, STEAM, AND ELECTRICITY SAVINGS with INCREASED AS WELL AS BETTER QUALITY SUGAR PRODUCTION.**

- YUTECH Fluid-Density-Brix Sensing does not involve any Complicated and Unnecessarily Expensive Technologies like Microwave, or, Torque sensing, or earlier techniques OF RF, or HF Conductivity.

- YUTECH Motorized Fluid-Density Sensor and Analyzer Set measures the Power required by the Motor to agitate and stir the Massecuite / Syrup. This Sensed Power is converted first into Density (Kg/m^3) and then into Brix using **YUTECH Fluid-Density-Brix Equation** which is a set of Complex Mathematical Formulae which linearizes the Power and Converts it into Brix. It further **Compensates for Pan Level and Temperature**.

- **YUTECH Batch Pan Control Algorithm** is based on years of experience and interactions with numerous Pan Operators, Chemists, Process Managers, and Engineers in a vast number of Sugar Factories.

- Steam Economy norms have reduced the Pan Boiling Temperatures to about 90^oC or lower, which has substantially reduced Steam Consumption. However, the Flip Side of this is Lower Natural Circulation within the Pans, which leads to many problems like False Graining, and Pocket Formation. **YUTECH** insists on Mechanical Circulators to restore the Circulation and Circulator Speed Variation as per Process Conditions and Temperature to ensure that Material is forced to Circulate. **Thus, Ensuring NO FALSE GRAIN OR POCKET FORMATION.**

BATCH PAN AUTOMATION
PROCESS CONTROL DESCRIPTION

YUTECH approaches Batch Pan Automation from the Process Point of View, and not a typical Automation Perspective.

We aim to achieve maximum throughput in the same Batch Time by properly controlling process parameters to improve process dynamics, resulting in consistent maximum capacity production, with the best possible grain size and sugar quality. The following Procedures are performed in a Controlled Manner:

- Completely or Partially Automated Batch Operations starting with the START Button press.

- Steam / Heating Vapour Valves Open Signal and/or Indication generated automatically. Valves will open Automatically if a Control Valve is installed otherwise, the Pan Attendant will open the Valve Manually after seeing the Steam/Vapour Valve OPEN Indication.

- Vacuum Valves Open Signal and/or Indication generated automatically. Valves will open Automatically if a Control Valve is installed otherwise, the Pan Attendant will open the Valve Manually after seeing the Vacuum Valve OPEN Indication / Alarm.

- Vacuum Level will be adjusted Automatically as per Temperature, or the System will prompt the Pan-man to adjust the Vacuum Valve till it senses the proper Vacuum Value as per the Vacuum-Temperature Table. The Mechanical Circulator or Stirrer will start.

- The Initial Build-up Stage now starts with Automatic Intake of Graining Volume or Pre-Formed Footing has been Cut-In. Pan-man can make this choice by pressing the Cut-In Button or Graining Volume Intake Button on the System / SCADA. The material will be filled as per the Pre-Set Level and PID Control Action will be given a Fluid-Density-Brix Remote-Set Point.

- Stirrer Speed is varied as per pre-set Pan Level (WE RECOMMEND THE CIRCULATOR BE FITTED WITH VFD FOR HIGHER THROUGHPUT AND EXCELLENT RESULTS ESPECIALLY FOR A MASSECUITE PANS). Steam / Vapour will be adjusted again if required.

- Controls will automatically switch to CONCENTRATING MODE on achieving Pre-Set Level, which is the Graining Volume, and the Vacuum will be adjusted accordingly if a Control Valve is installed otherwise the Local Indicator will prompt the Pan Attendant to adjust the Vacuum as per Vacuum Table.

- The System will ask the Pan-man to choose Starting Material as Syrup / Molasses or Pre-Formed Footing Material by Pressing one of these two Buttons.

- If the Starting Material is Syrup or Molasses, the Concentration will immediately start Fluid-Density-Brix Analyzer will sense the Density-Brix. Once the Syrup / Massecuite achieves Graining Brix Value and attains Super-Saturation, the Graining Stage will start.

- At this Stage, the Pan Attendant / Pan-man can intervene and perform Cut-Over operation whenever required by pressing the Cut-Over Key (This is done in Assisted Semi-Automatic Mode) and sending this material to another Pan as Pre-Formed Footing Material or continuing with the Graining Process. If the Cut-Over key isn't pressed the System will automatically continue and move on to the Graining Process.

- The Graining Process begins with an Indication with an Audio-Visual Alarm given to charge the slurry, after seeing this Alarm and confirming the time and massecuite density, the Operator will charge the slurry.

- Fondant Sugar Slurry or Alternate Slurry aids in Grain Growth and the Massecuite starts thickening. At this time, the System will maintain the Brix by immediate addition of Movement Water. Steam Pressure will also be suitably adjusted. This Graining Process will continue for a specified period after which the System will prompt the Pan-man to check Grain Stability. Once the Grain is stabilized, Pan-man will acknowledge the Grain Stability by pressing the Grain Stable Button.

- If the Starting Material chosen was Preformed Footing Material, then the Graining Process will start immediately with the addition of Movement Water to control Brix as per the Graining Brix Set Point. In this case, the Fondant Sugar Slurry Addition stage will be Bypassed.

- The Pan Build-Up Stage now begins with the intake of the second material and building it up to the next level. Here again, the material will be concentrated and tightened to a Preset Density and Brix. This will be repeated till the Pan's full capacity is achieved. The System will prompt the Pan-man to check the Massecuite finally and drop the Pan.

- At this Last Stage there are two dangers, one is the formation of a second grain or false grain due to Excessive Super-Saturation. This condition is avoided by accurate Brix Control during the Last Stage and in rare cases where the Pan cannot be dropped due to congestion in the Crystallizers, Movement Water is added to dissolve these second grains.

- The second danger in the Last Stage or even in the Earlier Stages as the Pan Level Build-Up is that of the Original Grain Re-Solution at the bottom layers of the Pan. This is avoided by forcing a higher speed of circulation and avoiding Massecuite Stagnation at the Bottom of the Calandria.

- Automatic or Informed-Manual Vacuum and Steam Closure and Transfer or Dropping of Material to Other Pan / Seed Tank / Crystallizer can be made, as per Pan Type and Requirement.

- Wash Routine if needed is initiated by the Pan-Man by pressing Wash Button.

- Next Batch or Second Build-up started.

- YUTECH Batch Pan Automation is available with any PLC / DCS Platform of the customer's choice.

YUTECH also offers a Local Standalone Batch Pan Controller.

Accurate Fluid-Density-Brix reading ensures better Process Control and helps to maintain constant Massecuite / Melt / Molasses / Syrup Quality and Steam / Vapour Requirement thus resulting in Higher Sugar Production Efficiency and Minimum Process Losses.

BATCH PAN AUTOMATION

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

SALIENT FEATURES OF FLUID-DENSITY-BRIX ANALYZER SYSTEM:

- 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.
- MOTORIZED SENSOR'S TORQUE AND POWER WHICH IS REQUIRED TO STIR THE FLUID VARIES WITH VARYING FLUID-DENSITY. SO THE MOTORIZED FLUID-DENSITY SENSOR'S POWER CONSUMPTION IS DIRECTLY PROPORTIONAL TO THE FLUID'S DENSITY.
- THE VARIATION IN SENSOR'S POWER CONSUMPTION IS SENSED BY THE FLUID-DENSITY TYPE BRIX ANALYZER'S HIGHLY ACCURATE SENSING CIRCUITRY, THIS VALUE IS MEASURED AND PROCESSED IN THE **FLUID-DENSITY-BRIX EQUATION,** TO DERIVE THE ACTUAL VALUE OF **DENSITY IN KG/M^3 AND TEMPERATURE, LEVEL AND VACUUM COMPENSATED BRIX VALUE.**
- **COMPENSATED BRIX VALUE IS DISPLAYED OR TRANSMITTED AS 4-20mA CURRENT OUTPUT.**
- EASY AND USER-FRIENDLY CALIBRATION AND ONLINE COMPENSATION.

BASIC SCIENCE BEHIND FLUID-DENSITY-BRIX:

- **FLUID-DENSITY:** THE DENSITY OF A PARTICULAR FLUID.
- **DENSITY IS DEFINED AS "MASS PER UNIT VOLUME, " MEANING** THE MASS CONTAINED IN A FIXED VOLUME. IT IS DENOTED BY "**ρ**", 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/M^3** (KILOGRAM PER CUBIC METER).
- **BRIX:** THIS IS THE PERCENTAGE MEASUREMENT BY SUCROSE WEIGHT IN PURE WATER SOLUTION.
- **THE MOST POPULAR WAYS OF MEASURING BRIX ARE:**
  - **HYGROMETRIC AND REFRACTOMETRIC (LAB METHODS)**
  - **HIGH-FREQUENCY OR RADIO-FREQUENCY CONDUCTIVITY TYPE BRIX SENSING. THIS ANALYZER SENSES THE CHANGE IN AMPLITUDE OF THE SIGNAL PROPAGATED IN THE MEDIA WHICH IS PROPORTIONAL TO THE MEDIA'S WATER CONTENT.**
  - **MICROWAVE TYPE BRIX SENSING. THIS ANALYZER SENSES THE PHASE SHIFT OF THE SIGNAL PROPAGATED IN THE MEDIA WHICH IS PROPORTIONAL TO THE MEDIA'S WATER CONTENT.**
  - **YUTECH'S INNOVATIVE FLUID-DENSITY BRIX SENSOR, SENSES THE MOTORIZED STIRRER'S POWER REQUIRED TO STIR THE MEDIA AND SENDS THIS SIGNAL TO BRIX ANALYZER, WHERE, A COMPLEX MATHEMATICAL EQUATION WITH LINEARIZATION AND COMPENSATION FORMULAE ACCURATELY DERIVES TEMPERATURE, LEVEL AND, VACUUM COMPENSATED BRIX AND DENSITY IN KG/M^3.**
- WHILE CONDUCTIVITY OR MICROWAVE METHODS MEASURE THE FLUID'S ELECTRICAL CHARACTERISTIC, THEY ARE SUCCESSFUL IN MEASURING BRIX OF "B AND C" MASSECUITE IN CVP, BRIX OF SUGAR MELT, AND BRIX IN A MOLASSES CONDITIONER UNIT.
- "A" MASSECUITE HOWEVER, HAS A MIX OF MATERIALS LIKE SYRUP, MELT AND MOLASSES WHOSE PURITIES ARE DIFFERENT, THIS AFFECTS THE FLUID OR MEDIA'S ELECTRICAL CHARACTERISTIC WHICH IS VARIABLE FOR MASSECUITES OF DIFFERENT PURITY THUS ADVERSELY AFFECTING BRIX MEASUREMENT.
- FLUID-DENSITY MEASUREMENT USES A MOTORIZED STIRRING SENSOR AND PROVES VERY SUCCESSFUL, AS IT DIRECTLY MEASURES THE FLUID'S DENSITY (TIGHTNESS OR THINNESS) IRRESPECTIVE OF ITS ELECTRICAL CHARACTERISTICS.

BRIX ANALYZER AND FLUID DENSITY BRIX SENSOR

SUGAR PROCESS AND REFINERY APPLICATIONS: SENSES BRIX AND DENSITY IN KG/M³

ACCURATELY SENSES BRIX AND DENSITY IN KG/M³ WITH VACUUM, LEVEL AND TEMPERATURE COMPENSATION

FLUID DENSITY BRIX ANALYZER TECHNICAL SPECIFICATIONS:

PRODUCT CODE: A15FDACFM1230 / A24FDACFMEM1230

- POWER SUPPLY: 85 - 265 VAC, 50 – 60HZ
- INPUTS:
  - FLUID-DENSITY SENSOR
  - RTD PT100 TEMPERATURE SENSOR
  - 8-POINT LEVEL SENSORS (CONDUCTIVITY-BASED DIGITAL SWITCH TYPE)
  - 4-20MA: INPUT FROM VACUUM TRANSMITTER (OPTIONAL, NOT A PART OF STANDARD SUPPLY)
  - 4-20MA: INPUT FROM DIFFERENTIAL PRESSURE TRANSMITTER WITH EXTENDED DIAPHRAGM WITH CAPILLARY TUBES (OPTIONAL, NOT A PART OF STANDARD SUPPLY)
- OUTPUTS:
  - TRANSMISSION OUTPUTS: 4-20MA, BRIX OUTPUT, AND 4-20MA, LEVEL OUTPUT (REQUIRED FOR BATCH PAN APPLICATION)
  - PID CONTROL OUTPUT: 4-20MA FOR BRIX CONTROL
  - 2 POTENTIAL-FREE RELAY OUTPUTS
- DISPLAY:
  - FOR PRODUCT CODE - A15FDACFM1230: 7-SEGMENT LED DISPLAY
  - FOR PRODUCT CODE - A24FDACFMEM1230: 7-SEGMENT LED DISPLAY AND LCD DISPLAY
- ENCLOSURE: FIELD MOUNTED MS POWDER COATED, INGRESS PROTECTION CLASS IP67
- COMMUNICATION:
  - ETHERNET: MODBUS TCPIP (PRODUCT CODE: A24FDACFMEM1230)

FLUID DENSITY SENSOR TECHNICAL SPECIFICATIONS:

PRODUCT CODE: A24FDSRS1, A24FDSRS2, A24FDSRS3

- TYPE: MOTORIZED FLUID DENSITY SENSOR
- POWER SUPPLY: 24VDC FROM THE ANALYZER (NOT TO BE CONNECTED TO ANY EXTERNAL SOURCE).
- BUILT-IN THERMOWELL WITH RTD PT100
  - MATERIAL OF CONSTRUCTION: SS304 / SS316L
- PTFE SHEATHED CONDUCTIVITY PROBE 8 NOS.: SS304 / SS316L WITH PTFE SHEATH
  - MATERIAL OF CONSTRUCTION:
- MATERIAL OF CONSTRUCTION:
  - WETTED ROTARY PARTS: SS304 / SS316L
  - WETTED STATIONARY PARTS: MS CHROME PLATED / SS304 / SS316L
- FOR FOOD-GRADE, SS-304 FULL SENSOR BODY: ADD FGSS TO THE PC. EX: A24FDSRS3FGSS
- FOR ACIDIC CHEMICALS, SS-316L FULL SENSOR BODY: ADD SSL TO THE PC. EX: A24FDSRS3SSL

FLUID DENSITY SENSOR MODEL GUIDANCE FOR VARIOUS APPLICATIONS:

A24FDSRS1: BATCH PAN, VERTICAL CONTINUOUS PAN

A24FDSRS2: HORIZONTAL CONTINUOUS PAN

A24FDSRS3: EVAPORATOR, FALLING FILM EVAPORATOR, JUICE AND SYRUP MIXING VESSEL, SUGAR MELT, MOLASSES CONDITIONER, LIME BAUME

A24FDSRS3FGSS: BREWERIES, FOOD & BEVERAGES, DAIRY

A24FDSRS3FGSSL: CHEMICALS, DISTILLERY SLOPE / SPENTWASH

A24FDSL: SWITCHING LEVEL SENSOR

PLEASE GIVE INFORMATION OF MEDIA BRIX RANGE, DENSITY RANGE, pH, TEMPERATURE

PLEASE VISIT OUR WEBSITE www.yutechautomation.com.

YU Technologies Pvt. Ltd.
HO & Works: B 8/5, MIDC, Miraj, 416 410, Distt: Sangli, Maharashtra, India.
T: +91 233 2644042, +91 916 832 4851, +91 916 832 5127 / 8.
E: info@yutech.in; sale@yutech.in
W: www.yutech.in; www.yutechautomation.com

CHANNEL PARTNER: