

Using pH and Conductivity to Enhance Brewing Quality & Sustainability

Agenda

- Gusmer & Hamilton Overview
- Easyferm Bio HB Arc pH Sensor
- Conducell 4USF Arc Conductivity Sensor
- Inline Applications pH and Conductivity
- Sensor Housings
- Calibration
- ArcAir Software
- Q & A Type questions in the Q/A box



Service with Knowledge ® since 1924

Founded in 1918

Management and Ownership currently in 3rd generation

FERMENTATION & FILTRATION PRODUCTS AND SERVICES for FOOD, BEVERAGE & BIOTECH/PHARMACEUTICAL APPLICATIONS

Manufactured and Resale Products

15 Direct Technical Sales Representatives

4 Product Managers &3 Application Specialists

16 Research & Development Scientists



www.GusmerEnterprises.com



Tom Mondor

Company: Gusmer Enterprises Inc Phone Number: (715) 417-0623 Email: tmondor@gusmerenterprises.com

Brewing Distilling WineMaking Juice Processing

Hamilton Overview

- The Hamilton Company has been manufacturing precision measurement devices for over 60 years
- Partnership between Gusmer and Hamilton was established in 2014
- Gusmer is Hamilton's sole distributor for the beverage industry



Application Points



Easyferm Bio HB Arc

- pH 0-14 with integrated transmitter
- High quality Hamilton Everef Reference System and HB Glass
 - Precise and stable sensor slope and offset
- VP 8.0 connector
- Wi2G Bluetooth Adapters available





Easyferm Bio HB Arc



Easyferm Bio HB Arc



Conducell 4USF Arc

- Measuring Range: 1 uS up to 300,000 mS
- Measurement Principle: 4 Pole Contacting Electrodes
- Communication 4-20 mA analog, MODBUS RS-485 Digital, Bluetooth Adapter Compatible
- Operating Temperature: 0 110 °C for Analog, 0 – 140 °C for Digital





R = V / I $\rho = R (A / \ell)$ $\sigma = 1 / \rho$

4 Pole Conductivity

- AC voltage is applied across the two outside electrodes (similar to 2-electrode design)
- Voltage drop is measured across the 2 inner electrodes
- Using a known current, resistance can be calculated with voltage drop, its resistivity calculated, and then converted to conductivity using the inverse
- 4 Pole design provides increased performance in higher concentration and higher temperature environments
- NOTE Although Conducell 4 Pole is a popular conductivity sensor choice, Hamilton does have non-contact (toroidal) conductivity probes available as well



Inline Applications pH and Conductivity

Inline Applications – pH and Conductivity

Brewing And Quality Impacts

- RDF
- Yield
- Lautering Throughput
- Phenol Extraction
- Turbidity
- Hop Utilization
- Perceived Bitterness
- Color
- Trub removal
- Brewhouse Fouling
- Wort Oxidation
- Yeast Health

- Microbiological Control
- Fermentation Speed
- Ester Formation
- CO2 Saturation
- Diacetyl Formation
- Yeast Flocculation
- Acetaldehyde Formation
- Chill Haze
- Beer Stone Control
- SO2 Formation (Freshness)
- Taste
- Mouthfeel

And More!

Financial Impacts

- Raw Material Costs
- Capacity
- Water Usage
- Beer Loss
- Labor Costs
- Repeatability
- Quality Control
- Marketable Beer Styles
- CIP Frequency
- Maintenance Costs
- Byproduct Value
- Utility Expenses
- Gov't Taxes and Fees

Inline Applications – pH and Conductivity



Inline Applications – pH

Sour Beer Production





Process and Microbiological Monitoring

Inline Applications – Conductivity

CIP Applications



Brand Integrity and Process Loss Prevention



Inline Applications – pH and Conductivity

Waste Water

Typical Ranges Of Brewery Pre-Treated "End-Of-Pipe" Wastewater Effluent

PARAMETER	TYPICAL RANGES
BOD	100 - 400 ppm
рH	6-9
TSS	50-500 ppm





Inline Applications – pH and Conductivity

Brewing Water Makeup



Brewing Style Water Profiles

	Suggested Water Profiles for Lager Styles							
Туре	Color	Bitterness	Ca ⁺²	HCO ₃ -1	Cl-1	SO ₄ ⁻²	RA	Styles
Light Lager	pale	soft	50	0-40	50-100	0-50	-60-0	Lgt and Standard Am. Lager. Munich Helles
Medium Lager	pale	moderate	50-150	0-80	50-100	50-150	-60-30	Am. Prem. Lager, German and Am. Pils
Medium Lager	amber	soft/moderate	50-75	40-120	50-150	0-100	0-60	Vienna, Oktoberfest
Medium Lager	brown/black	soft/moderate	50-75	80-120	50-150	0-50	40-80	Am. Dark, Munich Dunkel, Schwarzbier
Strong Lager	amber	soft/moderate	50-75	40-80	50-150	0-100	0-60	Maibock, Tradition Bock, Dopplebock
Strong Lager	brown/black	soft/moderate	50-100	80-150	50-100	0-100	60-120	Trad. Bock, Dopplebock, Eisbock, Baltic Porter

Brewing Style Water Profiles

	Suggested Water Profiles for Ale Styles							
City/Style	Color	Bitterness	Ca^{+2}	HCO ₃ ⁻¹	Cl-1	SO ₄ ⁻²	RA	Styles
Light Ale	pale	moderate	50-100	0-80	50-100	100-200	-60-0	Blonde, Am. Wheat, Stand. Bitter, Best Bitter
Light Ale	amber	soft/moderate	50-150	40-120	50-100	100-200	0-60	Eng. Mild, Scottish, Stand. Bitter, Best Bitter
Light Ale	brown/black	moderate	50-75	80-150	50-100	50-150	30-90	Eng. Brown, Brown Porter, Dry Stout
Medium Ale	pale	soft/moderate	50-100	0-80	0-100	0-50	-30-0	Weizen, Witbier, Cream, Blonde, Kolsch
Medium Ale	pale	mod/assertive	50-150	40-120	0-100	100-400	-30-30	Am. Pale Ale/ XPA/ IPA/ Double IPA, Saison
Medium Ale	amher	mod/assertive	50 150	40 120	50 100	100 300	0.60	Althier Cal Common ESB Irish Red Am Amher
Wiedum	annoci	mou/ assertive	50-150	+0-120	30-100	100-500	0-00	Andrei, Cal. Common, LSD, Institted, Am. Amber
Medium Ale	brown/black	mod/assertive	50-75	80-160	50-150	50-150	60-120	Am/Eng. Brown, Brown/Robust Porter, Stout
								0
Strong Ale	pale	moderate	50-100	0-40	50-100	50-100	-30-0	Belgian Blonde, Golden Strong, Tripel
Ū.								
Strong Ale	amber	mod/assertive	50-100	40-120	50-150	50-100	0-60	Stotch Ale, Dubbel, Old Ale, Barley Wine
Strong Ale	brown/black	mod/assertive	50-75	120-200	50-150	50-150	120-200	Baltic Porter, Russian Imp. Stout, Weizenbock

Sensor Housings

- Tri-clamp and Varivent fixed place housings
 - Angled options available for increased cap life





Calibration

- Hamilton Certified Calibration Standards
 - Standards as low as 1.3 us
 - Shelf life as long as 3 years
- Calibrate using the standard(s) that are closest to your specific operation
- Quick and convenient calibration using ArcAir software

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-	HAMILTON	No on 100 million	Conductivity Standard	1413.45
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Available on PC (Windows) and Mobile Devices (Apple/Android)



Monitor up to 30 sensors simultaneously



Communicate with sensors and record data over time to a PC



Convenient sensor calibration, configuration, and troubleshooting



GMP Compatible reporting, event tracking, and traceability





ArcAir



Operating indicators -



?	•••
DO 9.91%-sat ▲ Warnings: 2	Reactor 453 DO 24.26°C Errors:
Sensor Health	
Quality Indicator	30 %
Operating Hours	3210.43 h
Max. Measurement Temperatu	ire 110 °C
Operating Hours Above Max. Measurement Temperature	0 h
Max. Temperature	130 °C
Operating Hours Above Max. Temperature	0 h
Number of SIP Cycles	0
Number of CIP Cycles	0
Number of Autoclavings	0
Warnings and Errors	Ð
Calibration DO: Calibra Warnings DO: Last ca successful	tion recommended, 🔸 libration was not

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81 - 100% Excellent 61 - 80% Good 46 - 60% Acceptable 36 - 45% Poor < 35%</td> Replace



 configuration
 Automatic documentation of each configuration and calibration

Warning text strings

DO: Calibration recommended, DO: Last calibration was not successful

Questions?



www.GusmerBeer.com/hamilton-webinars

• Tuesday, March 23rd, 1pm EST

Niche Applications for ORP Monitoring in the Brewing and Seltzer Market

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Tom Mondor

Company: Gusmer Enterprises Inc Phone Number: (715) 417-0623 Email: tmondor@gusmerenterprises.com

Brewing Distilling WineMaking Juice Processing



Thank You!

