# **TOSILON AUTOMATION**

# **Concentration & Density Monitoring**

# REFRACTOMETER

# **PRODUCT CATALOGUE** &TECHNICAL BROCHURE

**TOC-1** Series

# **Inline Concentration / Density Meter**

English Version - VER.2403X1 March 2024

## **Brief Introduction**

TOC-1 Series refractometer is specifically designed for inline monitoring on refractive index. As a high precision instrumentation, the TOC-1 series has wide range for industrial process application. Featured by the measuring method, the TOC-1 is capable of measuring transparent liquids, translucent liquids, liquids with granule, gelatinized liquids, polymer liquids, etc.

#### **Working Principle**

The measurement is based on "total reflection and refraction of light". The illuminant adopts the laser of wavelength ( $\lambda$ =635nm). Passing through the lens, the parallel beam generated from the sensor will transmit to the liquids measured. When the beam return back to the sensor, optical path is then distributed by prism processing, and refraction is generated on the transverse surface. According to the lens, the 2 generated beam are focused to create slit images on image sensor's CCD. Refraction angle is determined by the difference of 2 slit images. In addition, the sensor integrates auto-compensation of pressure and temperature.

By adopting the laser refraction method for fixed wavelength laser, according to Snell's law of refraction, the liquids' refractive index "n" could be calculated.

#### $n_i * \sin \theta_i = n_t * \sin \theta_t$

- n -Beam's refractive index in the liquids
- θ Incident Angle
- nt Beam's refractive index in the lens
- θ₊ **Refraction Angle**

# **Typical Application**

Chamical Industry	$H_2SO_4,HCL,HydrofluoricAcid,FluosilicicAcid,BoronicAcid,Phosphoric$	Beverage	Juice, Milk,
Chemical muustry	Acid, NaOH, Inorganic Salt Solution, Ammonia, Hydrogen Peroxide, etc.	Textile & Paper	Black & Gre
Pharmaceutical Industry	Medical Intermediate, Solvent, etc.	Petrochemical	Emulsified (
Sugar Industry	Cane Sugar, Beet Sugar, Malt Sugar, Fructose Syrup, Glucose, etc.		
Semiconductor	H <sub>2</sub> O <sub>2</sub> , High-Purity Solvent, etc.		
Biological Industry	Sucralose, Citric Acid, Lysine, Lactic Acid, Biological Fermentation, Extraction		
	Process, etc.		





Beverage	Juice, Milk, Beer, Alcohol, Coffee, etc.
Textile & Paper	Black & Green Liquor, Sizing Agent
Petrochemical	Emulsified Oil, Cutting Oil, Glycol, Lube

# **Technical Index**

**Basic Technical Parameters** 

Item		Specification	Remark
Measuring Type		Concentration, Density, Brix	Inline Measurement
	Concentration	0.00~100.00%	
Measuring Range	Density	0.000~2.000	g/cm <sup>3</sup>
	Brix	0-100 Brix	
	Concentration	0.5%	
Accuracy	Density	±0.001	g/cm <sup>3</sup>
	Brix	0.5%	
Resolution		0.01%	
Operation Temperature Range		0~80 or 0~120	Deg. C
Max. Operation Pressure		207 bar	
Viscosity Range Accepted		0~20000	сР
Temperature-Compensation		Available	
Pressure Influence		Negligible	
Temperature Sensor Integrated		PT1000	
Wetted Part Material		Optical Glass, Sapphire, YAG, Stainless Steel, PTFE	
Enclosure Material		Aluminum Alloy coated by Polyurethane	
Measuring Interval		1.0s (abbr.)	
Output		4-wire; 4~20mA, via HART	
Power Supply		24VDC, ≥500 mA	
Process Connection		Thread, Flange, Sanitary Clamp	
Protection Class		IP67	
Ex-Proof		Exd IIC T6	
NOTE			
• Once the type of measurement is selected, it is fixed and is not adjustable			

For instance, if concentration is selected, this meter cannot be switch to density measurement

# Installation

#### Tank Mounting

## Installation Method

- Flange
- Clamp
- · Thread
- · Direct Insertion

#### NOTE

- · Sensor shall be totally submersed
- Stationary State: ≥200mm over the sensor
   Agitation State: ≥200mm over the sensor
   Sensor shall be away from the agitator
- For sediment environment, 2 pcs meters
- are recommended for the service by tank top and tank bottom mounting.

# Y Type Lateral Pipe Installation

- NOTE · Fluid' Velocity < 0.8 s/m
- · Fluid shall be by uniform flow
- · Fluid does contain bubble
- Flange > DN50



# Pipe Mounting

- 1. The TOC-1 is available for direct mounting for main pipeline under the condition the velocity is lower than 2.0 m/s
- 2. The distance of the pipeline before and after the TOC-1 shall be better 10x of the pipe size

# Vertical Pipe Installation (By-Pass Line)

# Description For Main Pipe with velocity > 3.0 m/s By-Pass line can reduce the velocity and minimize bubble NOTE

Distance (pump outlet to by-pass inlet) > 2.0 m



# Vertical Pipe Installation (Main Pipeline)

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Description			
•	For Main Pipe with velocity < 3.0 m/s		
	Flow Limiting Valve can reduce bubble		
NOT	Ξ		

Distance (pump outlet and the meter) > 3.0 m



## Horizontal Pipe Installation (By-Pass Line)

Description			
•	For Main Pipe with velocity > 2.0 m/s		
•	By-Pass line can reduce the velocity and minimize bubble		
	Flow Limiting Valve C or Orifice Plate		



# Horizontal Pipe Installation (Main Pipeline)

Description

Pipe Flange

- For Main Pipe with velocity < 2.0 m/s
- · Flow Limiting Valve can reduce bubble



# **Electrical Connection**

The TOC-1 Series is 4-wire based with 4~20mA output via HART. Grounding is available inside the enclosure or at the enclosure surface.

#### NOTE

- Without load, the display is off (backlight is off)
- For testing without load, terminal 1 and terminal 2 are available for 4~20mA
- Load≥500Ω, HART Terminal could be by short circuit (terminal 2 and terminal 3 in short circuit)

# Wiring Diagram



# Calibration

The TOC-1 unit has been well tested and calibrated during the production. Please correctly install the TOC-1 unit at the field. After the installation, the TOS-1 is ready to be power on for the service. If the calibration is required, please kindly refer to this manual. If there's any concern or question, feel free contact Tosilon.

# **Button Description**

Button	Description	
М	Function Button	
Z	Right Shift	
S	Left Shift / Adjust Value	



#### Menus

Menu No.	Function	Display	Remark
3	Lower Range Set	<b>•ДЛОООО</b> 3 G/CM3	Set based on site requirement
4	Upper Range Set	<b>•30000</b>	Set based on site requirement
5	Damping Time Set	, <mark>00000</mark> °	Default Value: Os
11	Master Variable Fine Tuning Set	<b>• 10000</b>	Master Variable Fine Tuning Set for Site

#### Lower Range Set

Step Des	scriptio	i
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1 Hold "M" for 3 seconds, then release "M", the interface will be

# 00000

Press "Z" to move the flashing position to the last bit,

2 then press "S" change number into "2", the interface will be Then Press "M" to confirm.

Press "M" to paging,

3 when the interface shown comes, Press "S" to inter this menu

Pressing "Z" to shifting the flashing position,

4 press "S" to adjust the value into 0.0000,

Then press "M" to save and paging to next menu.

# Upper Range Set

## Step Description

1 Hold "M" for 3 seconds, then release "M", the interface will be

Press "Z" to move the flashing position to the last bit,

2 then press "S" change number into "2", the interface will be Then Press "M" to confirm.

Press "M" to paging,

- 3 when the interface shown comes,
- Press "S" to inter this menu

Pressing "Z" to shifting the flashing position,

4 press "S" to adjust the value as required Then press "M" to save and paging to next menu.

# Damping Time Set

Step	Description	
1	Hold "M" for 3 seconds, then release "M", the interface will be	<i>00000</i>
2	Press "Z" to move the flashing position to the last bit, then press "S" change number into "2", the interface will be Then Press "M" to confirm.	<u>00002</u>
3	Press "M" to paging, when the interface shown comes, Press "S" to inter this menu	<b>.Ö0000</b> <sup>e</sup>
4	Pressing "Z" to shifting the flashing position, press "S" to adjust the value as required	

Then press "M" to save and paging to next menu.





•**28000** \* 570m3





#### **Master Variable Fine Tuning Set**

Description

Step

#### 1 Hold "M" for 3 seconds, then release "M", the interface will be

Press "Z" to move the flashing position to the last bit,

2 then press "S" change number into "2", the interface will be Then Press "M" to confirm.

Press "M" to paging,

3 when the interface shown comes,

- Press "S" to inter this menu
- Pressing "Z" to shifting the flashing position,
- press "S" to adjust the value as required (This value shall be the actual density value anticipated).
   Then press "M" to save and paging to next menu.

#### **Trouble Shooting**

#### Alarming Error (corresponding to output current)

- Checking the diagnosis information if the meter has error.
- Checking the "mV" value of the output and signal input device. Make sure the measuring range of the meter complies with the system setting.

## Measuring Value is not stable (jumping frequently)

- Checking if the pipe is fully filled by the fluids, also make sure the fluids is free of bubble.
- Checking the fluids' velocity, make sure the velocity is within the value required

## Measuring Value is higher

- Checking the position of the sensor, make sure the sensor is free of wall effect.
- Checking the fluids' character, including corrosivity, solid particle size and conglutination.
- Checking the pipe vibration condition. The intensive vibration will influence the measurement.

When there's error happen, please contact Tosilon. (mason.ding@tosilon.com)

## Remark

- Before running the meter, please follow Tosilon's instruction.
- The "Ground Protection" is recommended to be deployed.
- After wiring, check and make sure the cable glands and enclosure covers are tightly screwed.
- For any question or concern, please contact Tosilon.



