



DS-101 In-line Immersion Refractometer DRAFT

Operating Instructions 01/15/2020^o

This instrument is based on novel technology developed by **JSA Photonics** (US patent 10,145,789) and provides the user with a convenient ability to directly measure the refractive index (RI) of a liquid via an immersion technique. This instrument is designed for installation in liquid tanks or feed lines and provides continuous readings of RI and other convenient units including specific gravity, Brix (Plato) and Gravity calibrated for sugar solutions.



Prototype of DS-101 System

Safety Considerations

1. **Some liquids can be dangerous.** They may contain hazardous chemicals.
2. Foodstuff operation requires special caution to avoid contamination.
3. Installation and use should be performed by personnel familiar with safety procedures, safety equipment, and proper hygiene.
4. Failure to follow proper handling procedure may result in serious personal injury or contamination.
5. Contact with dangerous liquids may cause severe burns, eye damage and respiratory issues. If you come in contact with a hazardous liquid immediately rinse the area with cold water and consider consulting a physician.

Introduction

This device is used by submerging the active area of the glass probe (about 1”) shown above in the liquid under test. The probe must be completely submerged for accurate operation. The probe and display units are designed to be used under nominal indoor temperature conditions however the liquids under test may typically be measured within the range of 10-30 C without significant impairment of accuracy. Also note that the refractive index of most liquids depend on the temperature and compensation may be necessary in extreme cases. The unit is calibrated at 20 C. Step by step operation is described below.

Basic Installation and Operating Procedures

- The probe is sensitive and should be handled with care. Depending on where it is used it may require cleaning from time to time especially if the liquid contains material that may deposit foreign material on the probe after long periods of use. It may be gently cleaned using a soft cloth or paper towel moistened with tap water, alcohol or other human safe solvent and then rinsed. If used in foodstuffs, use special caution to clean the probe before re-installation..
- Depending upon which fitting the unit is equipped with carefully Install the probe assembly into the feed line or tank. If using a Triclamp to insure that the fitting has an o-ring inserted. With the conventional NPT fitting **do not attempt to screw the fitting into the line while holding the sending in your hand or damage may occur!** Use a wrench on the base of the fitting. Teflon tape or sealant may used if necessary.
- Mount the receiving unit near a 110VAC outlet. Connect and secure the DB-9 cables between the sending and receiving units. Plug the power jack into the receiving unit and then plug the power supply jack into the receiving. Lastly plug the power supply into the 110 VAC outlet. The unit should start immediately and begin to display units. Be sure that the probe is fully surrounded by the liquid. After a short delay the internal ambient temperature in centigrade degrees will be displayed, for example T= 27.2 C. Note that 20 °C (68°F) is approximately room temperature.
- After a short delay the refractive index will appear. For example “**RI=1.341**” along with other corresponding units. If the display reads “**RI = low**” that means the RI is below the range of the instrument. **RI = low** is also the normal indication when the probe is not immersed at all. If the display reads “**RI = high**” it means that the RI is above the range of the instrument. See note* below.

Precautions

- Most liquids have a temperature coefficient of about $-3 \times 10^{-4} \text{ } ^\circ\text{C}^{-1}$ thus for additional precision over the range of 0-30 °C this correction may be applied. Because of this variation in liquids and other instrument temperature effects, compensation is not automatic.
- The HR-110 is designed primarily for indoor use and its RI readings are referenced to 20° C (68°F). The liquid temperature under test may range over 0-30°C (32-86°F) and will not significantly impair the accuracy however if the temperature of the liquid exceeds this range, corrections may be necessary.
- A display reading of “**caution**” may mean several conditions. It may indicate that you are operating at an abnormal ambient temperature. In which case you may proceed anyway as long as the ambient temperature is approximately equal to the liquid temperature as described below. Lastly the condition may mean that the instrument is out of calibration.

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- Safety glasses and gloves should be worn during all hazardous liquid measurements. The probe itself may have a few drops of residual liquid on it. Do not touch the probe. Wipe it very gently with a paper towel. Dispose of the towel.
- This instrument is very sensitive and should be handled gently. Do not handle or place any mechanical force on the probe. Failure to observe this precaution may result in disturbing the instrument calibration.

Troubleshooting

A reading of **RI = Low** or **RI = High** may indicate that:

1. The instrument is out of its normal range; i.e RI is less than 1.333 or greater than 1.382.
2. The probe is operated in air.
3. Instrument failure.

The display does not light or register  when the instrument is energized may indicate:

1. A defective power supply or no AC power.
2. Instrument failure.

An incorrect RI reading means that the instrument is out of calibration.

Maintenance and Calibration

If the liquid contains material that would deposit on the probe it should be cleaned regularly.

Do not clean the display with anything other than water and a soft cloth.

A calibration solution (shelf life 1 year) is available to enable routine checks and adjustment of calibration. Insure the unit and solution re at normal room temperature. Remove the sending unit from the line or tank and fully insert the probe in the solution container and observe the reading. It should correspond to the reading on the Cal Liquid container $\pm .001$. If not, you may either simply correct subsequent readings for the difference or adjust the calibration by removing the small plastic plug located at the rear of the sending unit and **CAREFULLY** insert a small screwdriver in the hole and adjust the RI until it corresponds to the required value. See Cal Adj in the figure above. **The calibration solution contains common over-the-counter glycerol which is harmless but nevertheless should be kept out of the reach of children.**

***The user of this device hereby agree to indemnify and hold harmless JSA Photonics against all liability for any personal injury or illness, loss or damage to property, or costs, including court costs and attorneys fees that may result from or arise in its use .*