



## HH-100B Portable Electronic Hydrometer

### Operating Instructions 05/01/2019

This field instrument is based on novel optical technology developed by **JSA Photonics** and provides the user with a safe and convenient ability to directly measure the specific gravity (SG) and the corresponding state-of-charge (SOC) of open port, lead acid batteries. These batteries are commonly found in starting, lighting and ignition systems, stationary back up battery systems and motive power applications. It is intended for use by trained professional maintenance personnel. See disclaimer \*\*below.



#### Safety Considerations

1. **Batteries can be dangerous.** They contain hazardous chemicals and considerable energy.
2. Battery servicing and testing should only be done by personnel familiar with safety and proper safety equipment.
3. Failure to follow proper handling procedure may result in serious personal injury.
4. Contact with battery fluid can cause severe burns and eye damage. If you come in contact with the fluid immediately rinse the area with cold water and consider consulting a physician.
5. Do not service batteries near open flames or electrical sparks. Explosions may result.

#### Introduction

This device is used by submerging the active area of the glass probe (about 1") shown above in the battery electrolyte. The active area must be completely submerged. The instrument is self-calibrating and automatically initiates self calibration mode when the "on" button is pressed. It is designed to be used at normal room temperature although may be used within the range of 10-30 C without significant impairment of accuracy. Also note that the specific gravity of battery electrolyte does depend on the temperature and the unit is calibrated at 20 C. Step by step operation is described below.

## Basic Operating Procedures

- The probe must be clean and dry before each use. It may be gently cleaned using a wet soft cloth or paper towel with tap water and then dried. This is essential to obtain correct readings.
- Carefully remove the battery cap from the cells to be measured. Be careful not to come into contact with the battery fluid.
- Holding the unit in one hand press and hold the black button on the side of the unit. Do not release the button until the measurements are complete. “**HH100B**” will appear on the display. After a short delay the unit will initiate a self-calibration mode and display its internal calibration reference voltage which is approximately 2.50 volts. For example “**Cal = 2.54**”. Small deviations from this value are normal.
- 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. If your unit is equipped with a probe temperature option, the unit will display the probe temperature.
- While holding the on button gently submerge the active area of the probe in the battery fluid. Do not press the probe up against the plates of the battery or exert any pressure on the probe. The active region of the probe must be fully immersed in the fluid for correct results. See figure above.
- After a short delay the specific gravity reading will appear. For example “**SG=1.234**”. If the display reads “**SG = low**” that means the SG is below 1.10 . **SG = low** is also the normal indication when the probe is not immersed at all. If the display reads “**SG = high**” it means that the SG is above 1.35. See note\* below.
- Without releasing the “on” button proceed to measure other cells of interest.

\*The approximate charge level of the battery can be found by referring to the table on front panel of the device. Note that these are guidelines only and the specific relationship between SG and % SOC depends on the manufacturer and battery type and should be available from the battery manufacture. Typically a SG reading of 1.1 corresponds to a fully discharged battery or SOC = 0 %. An SG of 1.3 corresponds to SOC =100% or fully charged but these readings can vary.

## Precautions

- The HH-100 is designed primarily for indoor use and its SG readings are referenced to 20° C (68°F) . The unit may be used outdoors for brief periods of time but should not be stored in temperature extremes. Operation over an ambient temperature range of 10-30 °C (50-86°F) will not significantly impair the accuracy however if the temperature of the probe is significantly different than the battery fluid, errors may result and corrections may be necessary.

- A display reading of “**caution**” may mean several conditions. The most likely condition is that the probe is not clean. Clean and dry the probe and start over. It also 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 battery fluid temperature as described below. Lastly the condition may mean that the instrument is out of calibration.
- The instruments calibration will render most accurate results when the probe temperature during self calibration is approximately equal to the battery fluid temperature. If possible give the probe sufficient time to reach the temperature of the battery fluid before initiating operation.
- Safety glasses and gloves should be worn during all battery maintenance operations. The battery cap may have a residual amount of acid on its lower surfaces. After removal, place the cap on a disposal paper towel. The probe itself may have a few drops of residual acid on after removal from the battery. 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.
- If the “on “ button is released you have to start all over again beginning with cleaning and drying the probe

## Troubleshooting

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

1. The instrument is out of its normal range ; i.e SG is less than 1.10 or greater than 1.35 which is the nominal SG range of most batteries.
2. The probe is not immersed in a valid electrolyte. For example the instrument is operated in air.
3. Instrument failure.

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

1. A dead or defective battery.
2. Instrument failure.

An incorrect SG reading means that the instrument is out of calibration or the probe was not sufficiently clean and dry before starting the measurement: out of calibration.

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## Maintenance and Calibration

To replace the standard 9V battery, open the panel on the back side of the instrument.

The probe should be cleaned regularly. Clean **very carefully** with a cotton swab or paper towel and tap water or alcohol.

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. Follow normal measurement procedures and fully insert the probe in the solution container and observe the reading. It should correspond to the reading on the Cal Fluid container  $\pm .01$ . If not, you may adjust the calibration by **CAREFULLY** insert a small screwdriver in the hole on the right side of the instrument and adjusting the SG until it corresponds to the required value. See Cal Adj in the figure above. Rinse the probe carefully with clean, cool water and dry. **This 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 .*

## Antifreeze Concentrations

The HH-100 is capable of measuring antifreeze concentrations. Caution: Never remove a radiator cap from a hot engine. Burns may result. Radiator servicing should only be done by qualified service personnel. The concentration should be measured by immersing the probe of the HH-100 in radiator overflow. User is advised to consult the vehicle operating manual for the correct antifreeze type. Insure that the anti-freeze is at approximately the same temperature as the probe.

Most commercial anti-freeze solutions are mixtures of Ethylene Glycol and Propylene Glycol. The freezing points of these solutions are shown in the graph below. The corresponding antifreeze concentration can be read from the graph below given the SG reading. For example the recommended antifreeze concentration is approximately 40% for most conditions. The corresponding SG reading from the bottom graph is approximately 1.30.



### Freezing Points of Aqueous Glycol Solutions

