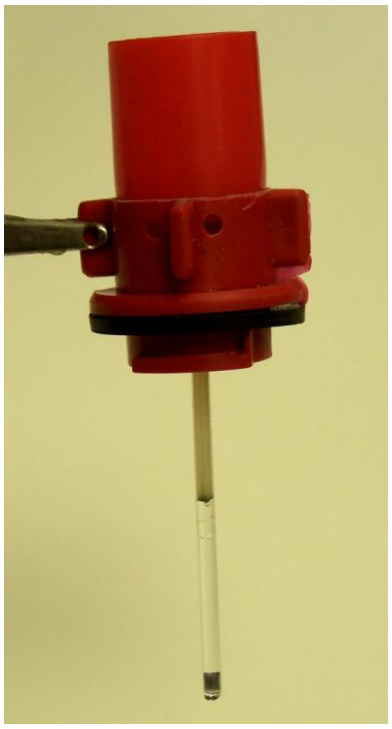
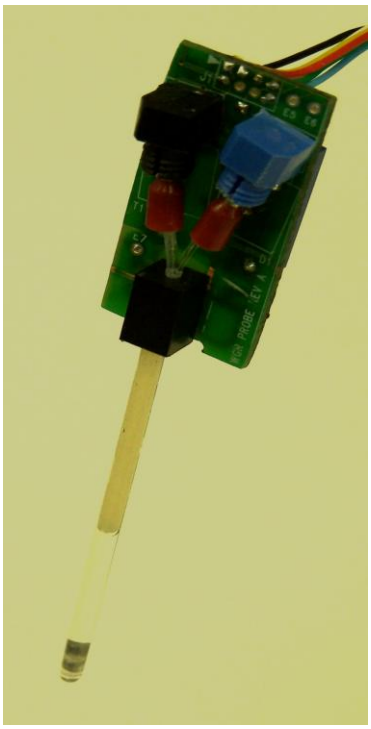
APPLICATION DATA: STATE of CHARGE SENSORS and LIQUID LEVEL SENSORS (07/01/2015)

STATE OF CHARGE (SOC) SENSING

The JSA State-of-Charge Sensors (US patent #6,356,675) are special purpose refractometers designed for use in lead-acid open port batteries. This device is designed to accurately determine state-of-charge (SOC) levels of individual cells. The sensor provides an analog DC output voltage approximately proportional to SOC and may be calibrated in any user convenient units including % charge or specific gravity. Ambient temperature is sensed by on on-board environmental thermistor. An optional immersion temperature sensor is available for accurate in-cell electrolyte temperature measurements. Related applications for this sensor include fuel gauging for electric vehicles, feedback sensor for "smart" charging applications and load management for solar and wind back-up battery systems.



Battery Cap Configuration



OEM Configuration

Configurations available include OEM for user packaging or a standard battery cap version as shown in the Figures above.

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LIQUID LEVEL (LL) SENSING

A version of this technology is available for liquid level sensing and can be used to determine the electrolyte levels of individual cells. The range of the LL extends from the tip of the probe to one (1") inch above the tip providing a DC output voltage from 0.8-2 volts approximately proportional to liquid level. The level sensor is equipped with a standard on-board environmental temperature sensor or an optional immersion temperature sensor for accurate electrolyte temperature measurements. The liquid level sensor is available in either the OEM or battery cap versions as shown above.

STANDARD EQUIPMENT

- The sensor requires 5 Vdc regulated input however an on-board regulator is provided to enable the user to supply power from a battery or other unregulated 6-37 Vdc source
- An on-board environmental temperature sensor with RT curve J calibration factor is standard equipment on both versions.
- The standard probe lengths are 2.25" and 4".

UPGRADES

Several upgrade options are available for either Battery Cap or OEM sensor versions:

- An optional immersion temperature sensor is available with either the SOC sensor or the LL sensor with an RT curve Z calibration factors.

- Custom probe lengths up to 4" are available in the SOC and LL sensors. Probe length is measured from the edge of the PCB in the OEM configuration or the bottom base of the cap shown above. The active region of the sensor probe extends approximately 1" upward from the tip.

SPECIFICATIONS*

Power : 5 VDC regulated input or optional unregulated input 6-37 VDC,
Max current draw 35ma.

Output: Typically SOC output is 1 - 4.0 VDC with a minimum of 1 volt swing over the specific gravity range from 1.1 to 1.30. For the LL sensor the output is 2.0 – 0.8 volts for 1" to 0" above the tip of the probe.

Output Load Impedance, 100 kΩ minimum

Typical Temperature Limits: -10 to 60 °C. Correction of the SOC output may be required for large environmental temperature variations.

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SOC Accuracy **< 5% with factory calibration. Accuracy may be enhanced with extended user calibration. Long term drift is < 1.5% with appropriate temperature correction. See typical response curve below.**

Temperature Sensor Accuracy **±5%**

OEM Dimensions: **1.5" x .8" x .75".**

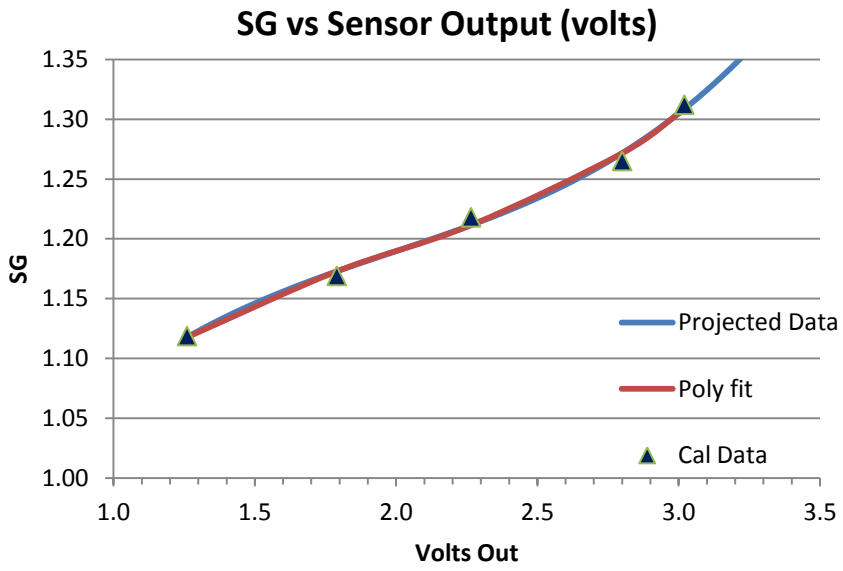
OEM Electrical Connector: **8 pin, 0.079" (2mm) dual row male header**

Battery Cap Electrical Connector: Supplied with an 8 wire, 3' pigtail. The cable is permanently mounted to the cap to avoid corrosion

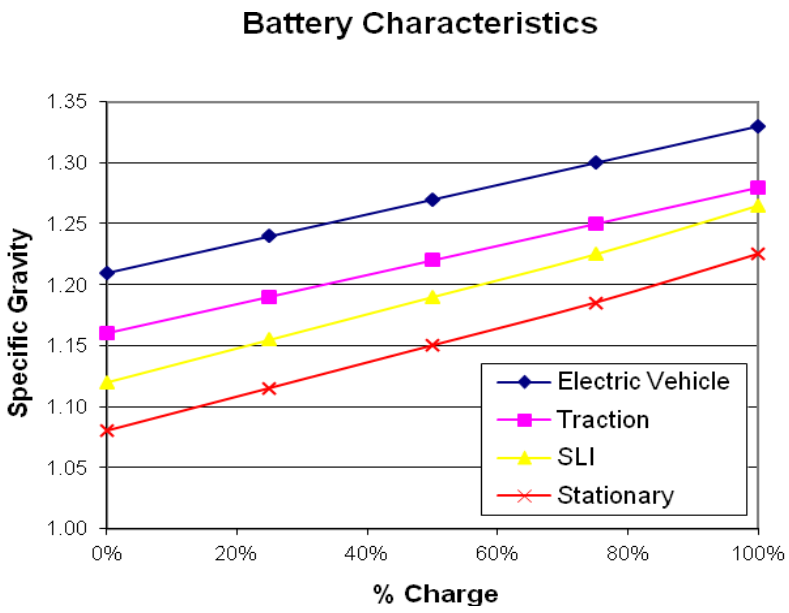
Calibration

Factory calibration (see figure below) is supplied as a courtesy and is not guaranteed. Units are delivered with 5 point calibration data representing the approximate range of SOC in terms of Specific Gravity (1.10 to 1.32) encountered in most lead acid batteries and supplied with Excel software enabling quick determination of SOC in terms of specific gravity from the output voltage on Pin 1 of J1. Periodic calibration checks against a battery hydrometer are recommended. The standard configuration is typically adequate for closed loop, smart charging and load management applications.

Typical Sensor Response

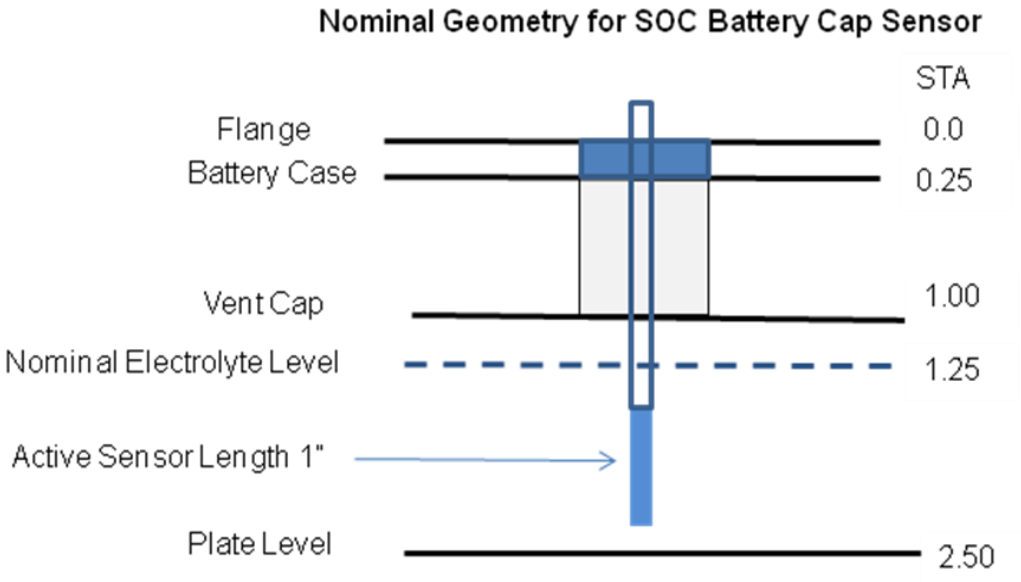


SOC in terms of % of maximum battery capacity is a function of battery type but can be approximately determined from the figure below.



USAGE AND PHYSICAL CONFIGURATION

The SOC sensor active element must be fully immersed in the electrolyte for satisfactory operation. This requirement demands that the battery electrolyte be maintained at a minimum level of 1" above the plates for satisfactory performance**.** Although the use of a sensor in each battery is recommended for critical applications, monitoring of single cell representative of each battery in the system or not less than 1 sensor for every 3-4 cells is the minimum number of sensors recommended. The sensor is built into a standard vented bayonet type cap as shown above compatible with many open port batteries. The required physical dimensions to install this cap into a lead acid battery are shown in the figure below. Custom probe lengths or alternate packaging configurations are available.



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PRECAUTIONS:

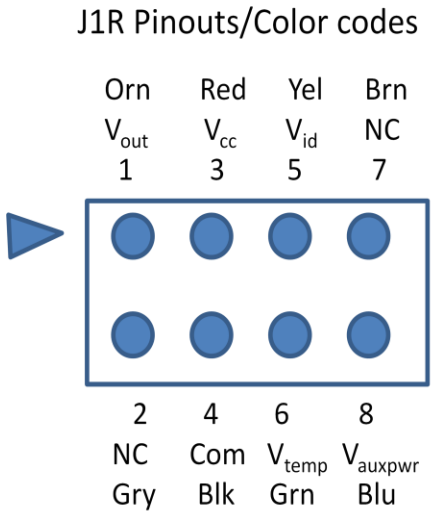
1. BATTERIES CAN BE DANGEROUS. Short circuits may cause fires and battery acid is corrosive and may cause burns or blindness. Do not attempt to install this sensor or otherwise service a lead-acid battery without observing industry standard practices.

2. Do apply power to pin 8 if pin 3 is active.

3. DO NOT APPLY UNFUSED BATTERY POWER, A 0.25 amp fuse is recommended.

4. The actual electrolyte temperature may differ from the environmental temperature. Apply corrections with caution.

J1-Electrical Connections / Cable Color Codes



1	**Vout**	**1-4 volts corresponding to specific gravity readings of 1.1 to 1.32**
2	**Com**	
3	**Vcc**	**Fused +5 VDC regulated input @ 35ma max**
4	**NC**	**Reserved**
5	**Vid**	**0-.35 Vdc out corresponding to 0-35ma LED diode current.**
6	**Vtemp**	**-5 volt output from environmental temperature sensor with RT curve J.**
7	**NC**	**Reserved**
8	**Vaux**	**Input to on-board regulator for battery powered operation. 6-37 VDC max.**

Temperature Sensor

Specific Gravity is a function of temperature. The on-board environmental temperature sensor output is on pin 7 of the J1 connector. The temperature in ºC can be approximately determined from the following expression:

$T(^{o}C) = (4.1451-V(pin7))/.0539$

The voltage output can be used directly as an input to the Excel calibration sheet provided with the sensor to correct for temperature effects.

* JSA reserves the right to alter specifications as necessary and without notice. Every attempt will be made to notify customers in advance of pending changes.

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