

## OPERATING PRINCIPLE

The NMTG consists of a vertical array of fiber optic sensors mounted on a support, which can be a solid rod or a flexible wire. For high accuracy measurements, the sensor support incorporates one or more pressure sensors depending on whether the vapor space is vented and whether the height of the tank exceeds 50 feet. The rod or wire is housed inside a pipe, of which one end is projected into the tank and the other end terminates in a signal conditioning enclosure at the top or the side of the tank. Figure 1 shows a typical NMTG and Figure 2 shows an NMTG mounted on a locomotive.

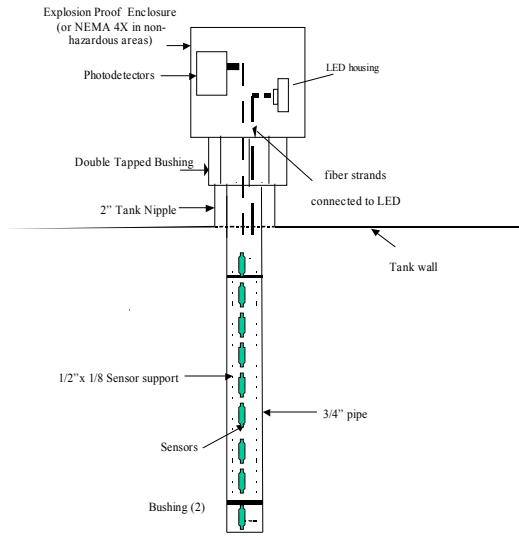
Light propagation in an optical fiber can be characterized in terms of a bound mode and a radiation mode. In the radiation mode, the light at the core/clad interface is refracted into the cladding in accordance with Snells' law, and is lost to the environment. As shown in Figure 3, the innovative feature of the Noverflo sensor is its unique loop configuration and the tapered apex cross section. These factors minimize the radiation loss when the sensor is exposed to air and maximize the loss when the sensor is exposed to the target liquid. The difference between the light loss to the air and the light loss to the liquid is used as the recognition signal. Changes less than 0.02 in the index of refraction can be detected with simple instrumentation. The loop of the NMTG sensors can be configured to provide maximum sensitivity and discrimination between different liquids. Because of the large difference between the index of refraction of air and liquids the NMTG sensors operate with very high excess gain (up to 16dB) consequently loose tolerances in sensor fabrication can be tolerated without adverse affects on performance. Consequently the NMTG is less expensive than any other similar instrument.

For relatively low accuracy (10 % -15% ) l measurements the NMTG sensors are arranged in a vertical configuration as shown in Figure 1 For moderate and high accuracy measurements the array incorporates a pressure sensor at the bottom of the tank, Figure 4 . For density stratified liquids, the hydrostatic pressure together with the NMTG sensors are used to measure both level and density. Sensors which distinguish between water and hydrocarbon liquids are used to measure water levels at the bottom of the tank.

For measurements in density stratified liquids, an alternate NMTG design incorporates a float, a pressure transmitter and one or two fixed level sensors, Figures 5 and 6.

[Click here for more detail information about NMTG options, capabilities and field experience](#)

Figure 1- Typical NMTG-L Tank Mounting

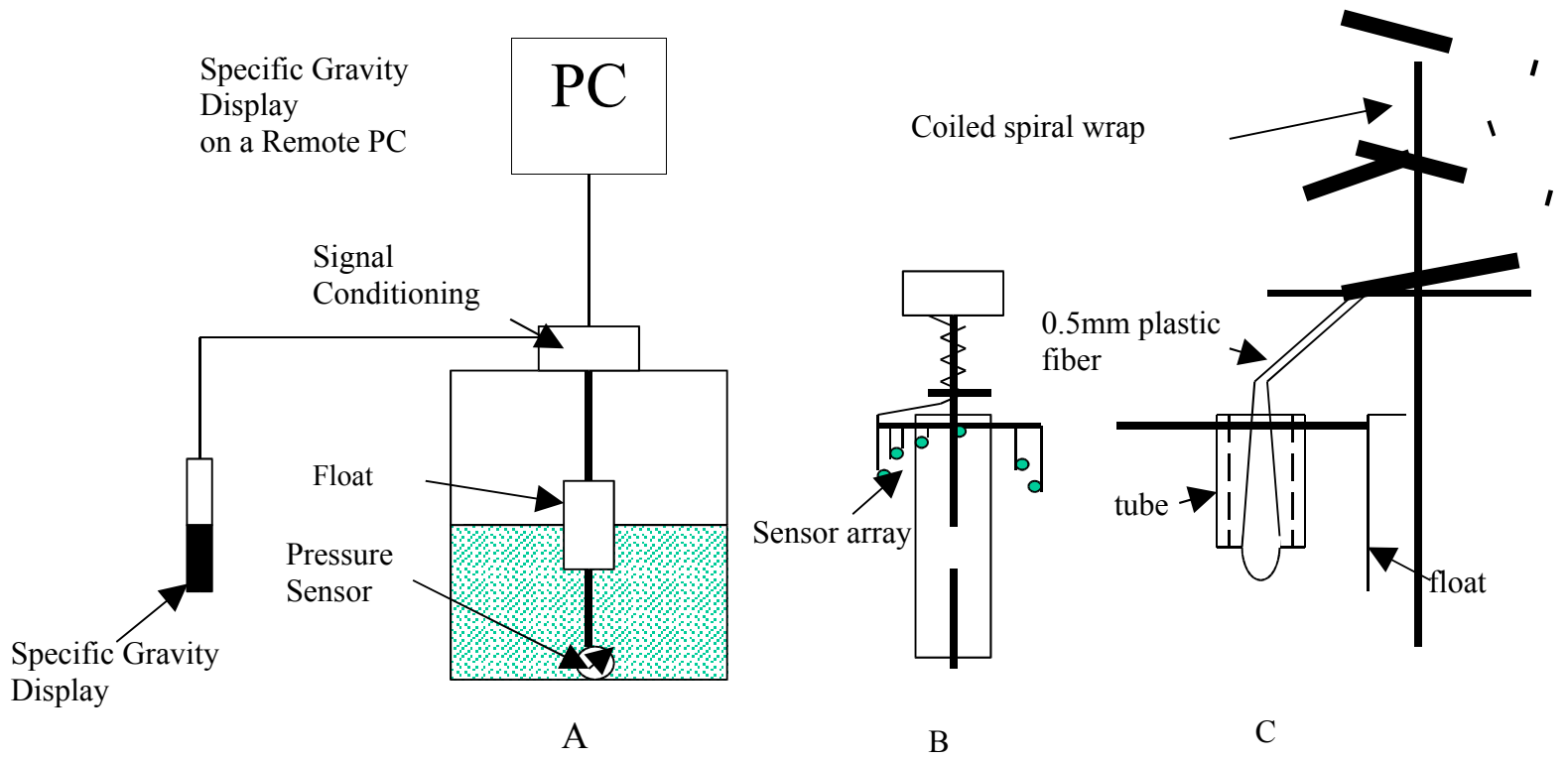




**Figure 2 -Locomotive Prototype (red bar graph indicates level)**

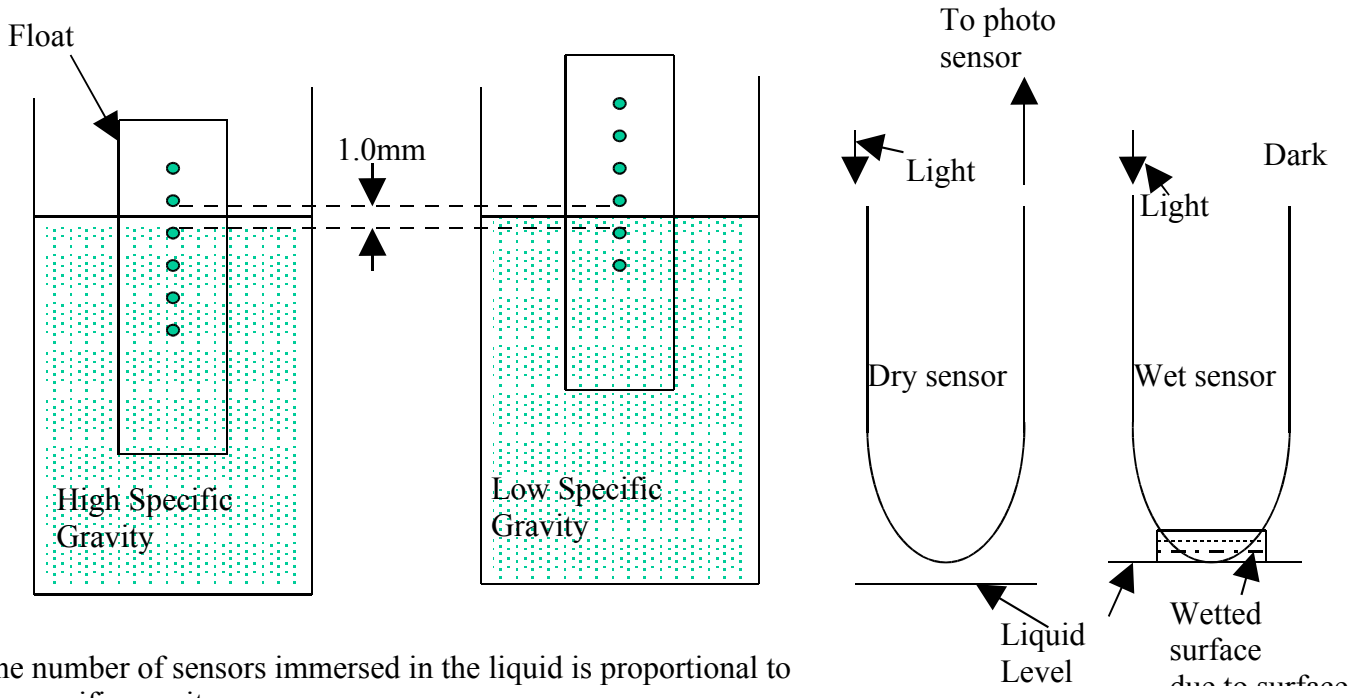






- A - Basic Components of the electronic hydrometer
- B - Sensor attachment to the float
- C- Sensor leads and connections to signal conditioning unit

Figure 5- Level and density measurements



The number of sensors immersed in the liquid is proportional to the specific gravity

Figure 6- Principle of specific gravity measurements. The light signal to a photo sensor depends on whether the sensor is wet or dry.