CARE OF THE 2100 SENSOR

The Sensor and propeller rotor assembly of the *Model 2100* Current Meter is the single most important part of the instrument and great care must be observed for its continued accurate output.

Keep the Sensor/Propeller assembly above the streambed when taking readings and avoid rocks and other hazards when moving from one measuring site to another. This prevents damage to the Rotor, Rotor Shaft, Propeller and the Sensor Body.

Never transport or store the sensor wand with the propeller rotor installed. *Use the 1/16" hex screwdriver to loosen the setscrew and remove the entire rotor assembly when not using the Model 2100.*

Always replace the batteries in the Model 2100 Indicator with fresh ones.

1. During rough use check the propeller frequently for frayed leading edges and for cracks. Chipped or cracked props should be replaced. Frayed leading edges can be brought back to acceptable levels of operation by reshaping them with 150 grit (or finer) sandpaper. Propellers that show signs of being bent or misshapen should be discarded.

2. Rotational friction is by far the biggest cause of erroneous data especially at velocities below 2 feet per second. Check the freedom of rotation frequently especially in turbid water or after rough handling. In some measuring situations it may be necessary to completely disassemble the rotor and clean the parts with clear water after each immersion. Use spare rotor assemblies and interchange them often. ***Never leave the rotor assembly attached to the sensor after taking readings.***

3. Water is the lubricant for the *2100-A21* rotor. "Canned air" and spray type degreasers may be used to regularly clean the "bore" of the Rotor (**2100-A27**) and the polished surfaces of the Rotor Shaft (**2100-A26**). Avoid oil & grease. Cleaning the rotor and its parts may be accomplished by using soap and water , alcohol, distilled water, etc. Avoid using any chlorinated solvents or strong alkalies. And remember whatever you use also needs to be cleaned off enough to satisfy environmental requirements.

4. The Rotor Assembly (**2100-A21**) should spin very freely when held in the vertical position (propeller pointing up) and simply blow lightly on the propeller. If it does not, clean the bore of the Rotor and the surface of the Rotor Shaft thoroughly.
One method to determine an acceptable level of low-velocity performance by a particular Rotor Assembly is to perform a "Spin Test":
Install the Rotor on the sensor, connect the sensor to the Indicator, and place the Indicator in the **COUNT** mode. With the propeller pointing up blow very hard straight down on the propeller. *At the instant you stop blowing* hit the **RESET** key on the indicator and allow the rotor to coast to a stop. A rotor, that will perform to the low velocity limits of its design, produces counts on the indicator of at least 300.

5. If the Rotor begins to "buzz" when spun by hand it means that the bore diameter of the Rotor (**2100-A27**) and the outside diameter of the Shaft (**2100-A26**) are too far apart. In this case it is advised to replace the Rotor with a new one. If the shaft shows visible signs of wear replace it also. Severe buzzing indicates that the rotor is bouncing off the shaft as it rotates around it. This slows the rotor significantly especially at velocities above 3 FPS and will cause readings to be slower than actual. **Note:** Some slight buzzing may be heard in the later versions of the rotor when it is spun "dry". This buzzing should cause no significant loss of efficiency.

6. Periodically examine the Thrust-Bearing Nut (**2100-A23**) and check inside on the bottom (the bearing surface). If a pronounced "cup" begins to form (wear from the ball-shaped end of the Rotor Shaft) the **2100-A23** should be replaced. This is especially necessary when using the *Model 2100* in low-flow situations, 2 FPS or lower.

7. The Photo-Optics in the sensor body must be kept clean. Use soap and water and a soft toothbrush to keep the "eyes" clean if necessary. *Be careful and do not scratch the Photo-optics as this could cause unwanted light scattering and therefore erroneous readings.* Likewise the Fiber optics "eyes" in the base of the Rotor (**2100-A27**) should also be kept clean.

Treat the *Model 2100* Rotor Assembly and Sensor with care and it will continue to produce accurate data with minimum maintenance.

CALIBRATION OF THE MODEL 2100 CURRENT METER

The *Model 2100* Current Meter is designed to be easily calibrated by the user. This calibration must be done with each Rotor you use. *The calibration numbers recommended by SWOFFER INSTRUMENTS, INC. are not necessarily correct for all measuring situations, therefore for optimum accuracy you should calibrate the rotors before use and at or near to the velocities expected to be encountered.*

If very accurate velocity measurements are required then you must calibrate your *Model 2100* system and check the calibrations often. The instructions below should be followed very carefully for reliable measurements using the *Model 2100*.

IMPORTANT NOTE: "Calibrating a sensor" is actually calibrating a particular propeller rotor for use with the *Model 2100* Indicator. If you use more than one rotor assembly you must check the calibration for *each* rotor assembly and adjust the Indicator Calibration Numbers accordingly as you switch from one propeller assembly to another.

Calibration numbers correctly matching a rotor assembly to a 2100 indicator are especially important at the lower velocities (1.5 FPS and lower) and can vary greatly depending on many factors; bearing surface condition in the rotor, make-up of the water being measured (amount of suspended particulates), any damage to the propeller, rotor, shaft, thrust-bearing nut, etc.

What a calibration number is:
The Model 2100 rotors produce four pulses per revolution. Each of the four fiberoptic "eyes" in the rotor triggers an electrical pulse from the sensor. These pulses are called "Counts" and are read by the Model 2100 Indicator. The Indicator uses these counts, measuring the number of them against an internal timer to determine velocity. The two calibration numbers in the Model 2100 therefore represent the number of counts a specific rotor produces as it travels through 10 feet and 10 meters of still water. When the sensor is *stationary* and water is moving past the propeller, a specific number of counts produced in a specific amount of time determines velocity when you know how many counts are produced per foot or meter (pitch). The calibration numbers then can also be referred to as Pitch.

Although rotor/propeller combinations are "similar" they are not necessarily "identical" and therefore each may have a slightly different Calibration Number. Always remember that the Calibration Numbers shown on the Indicator's display represent the Calibration Numbers for a single rotor assembly only. Double check all rotor assemblies used for any measuring job and make sure that each is within your accepted tolerance for calibration variation. Each rotor assembly may have a different calibration number. Only go out into the field with specific knowledge of each rotor assembly's calibration number. Make sure that the calibration number in the 2100 Indicator matches the rotor that is attached to the sensor before relying on readings.

CHECKING AND CHANGING CALIBRATION OF THE MODEL 2100

Before applying corrections to the *Model 2100* rotate the selector switch to the **CALIBRATE** position. A figure will appear in the display and will be either the FEET calibration number or the METERS calibration number depending on the position of the FEET/METERS switch (located in the battery compartment). For most measuring applications the calibration numbers will be about:

FEET	**=**	**186**
METERS	**=**	**610**

If the displayed figures are much lower than these figures the first thing to check is the battery. A weak battery can allow the indicator calibration numbers to "drift" downward slightly and will cause errors in measurements. Be sure to connect the sensor to the indicator when confirming battery strength. Always keep a *full charge* 9-volt battery in the compartment as a spare.

It is important to note that errors in measurements due to Calibration Number variation will be in direct percentage proportion to the difference *between the ideal (correct) Calibration Number for any rotor assembly and the number that the indicator displays.*
Example: If the calibration number is 186 for a particular rotor assembly and the Indicator-displayed number is 184 then the velocity error due to calibration error will be about 1%.

METHOD

To determine a reliable calibration number for your *Model 2100* perform the following: This is something you **must** do if you are working with slow flows (below about 1.5 FPS) and for measurements taken in very shallow streams.

Mark a straight course of 10 to 20 feet in length in a body of calm, current-free water along which the sensor can be towed by walking the course. A swimming pool or dock into a quiet lake serves well. Rotate the selector switch to the **COUNT** position. If the display does not show all zeros press and release **RESET**. (The decimal point does not show in the count mode.)

Place the sensor in the water a few feet before the beginning of the course, 6 to 12 inches below the surface. Make sure that the wading wand remains vertical throughout the distance traveled and that the tip of the propeller rotor faces directly into the direction of travel..Do not "crab" the rotor in the stream as you walk.

Begin walking the sensor through the course at a rate close to that which you will be measuring. If shallow flows are to be encountered try to duplicate those conditions when making calibration checks. Using the wand rather than the sensor as a guide, press and release **RESET** at the instant the wand enters the course. The indicator will begin counting the number of sensor pulses generated as you walk. At the instant the wand leaves the course press and release **START/STOP**. The display now shows (and will hold) the number of pulses generated over the course length. Several passes through the course in both directions are recommended to develop a reliable average figure. Repeat the above process as many time as necessary to establish an average for each rotor assembly you are to use.

Determine the average number of pulses generated through the course. If your course length is not 10 feet in length compute the number of pulses that the sensor would generate if the course were exactly 10 feet. This will be the CALIBRATION NUMBER that the *Model 2100* Indicator should hold for accurate measurements with that rotor assembly in feet per second:

$$\textbf{FEET CAL. No.} = \frac{\textbf{10 x AVERAGE No. OF PULSES}}{\textbf{COURSE LENGTH (IN FEET)}}$$

This number can then be multiplied by 3.281 (the number of feet in one meter) to determine the calibration number for meters.

Next, rotate the selector switch to the **CALIBRATE** position. Put the **FEET/METERS** switch (in battery compartment) in the "F" (FEET) position and the indicator will display the Calibration Number it presently holds for measuring in Feet Per Second. With a good battery it should be 180-186 (2” size props only). If your derived Calibration Number is different from the number displayed you can change the calibration number by using the **CAL ADJUST** screws at the bottom end of the indicator. Remove the **CAL ADJUST** cover screws (black plastic fillister-head screws). Then USING ONLY A JEWELER'S SCREWDRIVER (to prevent damage to the adjustment screw) rotate the screw clockwise to increase the displayed number and counterclockwise to decrease the number. Do the same for the Meters calibration number if necessary.

Each calibration adjustment screw is a 15-turn potentiometer with very fine resolution and plenty of latitude for normal adjustment given a full charge 9-volt battery.

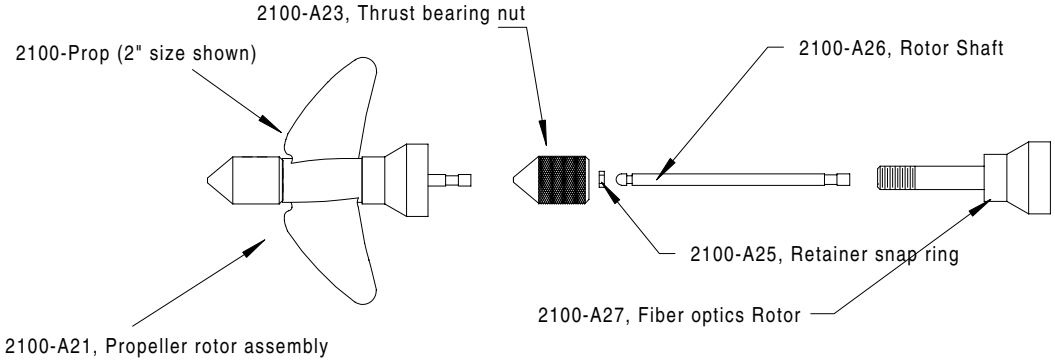
REPLACE THE ADJUSTMENT COVER SCREWS AFTER MAKING CALIBRATION CORRECTIONS. The Model 2100 INDICATOR IS NOT WATER RESISTANT WITHOUT THESE COVER SCREWS IN PLACE!

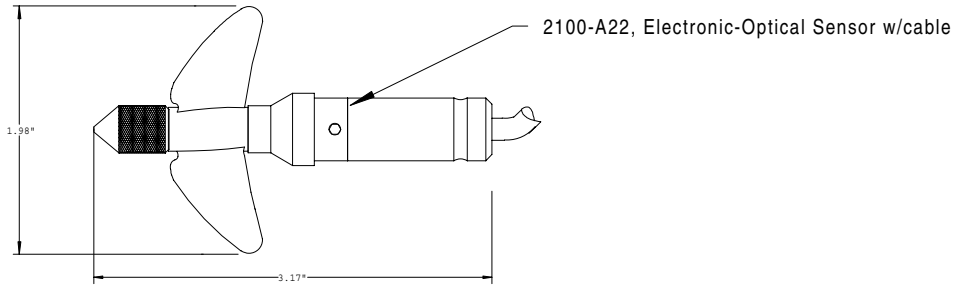
Note and store *with the Model 2100 Indicator* your new Calibration Number(s). Every time the instrument is used the calibration numbers and rotor assembly(s) that generated them should be confirmed and matched (rotate 2100 meter switch to **CALIBRATE**) before relying on readings. Also be sure to check the calibration number while the sensor is connected to the indicator to achieve maximum battery current draw.

IMPORTANT: Errors in measurements due to Calibration Number variation will be in direct percentage proportion to the difference between the ideal (correct) Calibration Number and the number that the indicator displays.

Approximate Calibration Nos.

PROP	*feet*	*meters*
2" propeller	186	610.27
3" propeller	130	426.53
1 3/8" propeller	217	711.98





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