

## DESCRIPTION AND INSTRUCTIONS FOR INSTALLATION OF METER HARDWARE

Although titled both a "current meter and a flowmeter", the Model 2200-3000 is actually a retrofit sensing and readout device that is designed to be used with existing Price Type AA and Pygmy current meters. These meters, developed by the U.S. Geological Survey, have been in use for over ninety years yielding reasonably accurate current velocity data by timed counting of "bucket wheel" revolutions. Meter construction is closely controlled and "standard rating tables" of velocity as a function of revolutions and time are published by the USGS. The original method of counting bucket wheel revolutions is by counting "clicks" generated in a headset by the bucketwheel-driven contactor. The interval over which the clicks are counted is determined by use of a stop watch. The stream velocity is then taken from the rating tables provided by the manufacturers and the USGS. Users not familiar with the Price Meters are referred to the WATER MEASUREMENT MANUAL and other publications prepared by the USGS.

Price Type Meters have been mechanically reliable for many years; however accuracy has been a function of careful maintenance and adjustment of the delicate "cats-whisker" contactors and proper lubrication of bearings and penta gears. Even with regular maintenance and the proper adjustments and operating procedures the Price Meters are not considered accurate below 0.2 feet per second. The inherent levels of friction caused by the cats-whisker contactors and the worm gears (AA Meter) inhibit bucket wheel turning at these velocities.

The optic sensor for the Model 2200-3000 is designed to eliminate as much friction as possible. The output signal of the sensor is produced by a non-contacting **PHOTO-FIBER-OPTIC** device that completely replaces the contact chamber assembly (AA Meter) and the cats-whisker contactor (Pygmy meter). Rotational friction is brought to minimum and accurate readings down to and below 0.1 foot per second are attainable under ideal conditions.

Once the sensor adapter parts are installed on the AA and Pygmy meters the 2200-A, photo-optic sensor can easily be placed on either meter as desired. The 3000 Indicator will then provide stream velocity readings and flow rates in any of several modes. This manual describes the installation of the optical retrofit sensor and adapters to AA and Pygmy type meters.

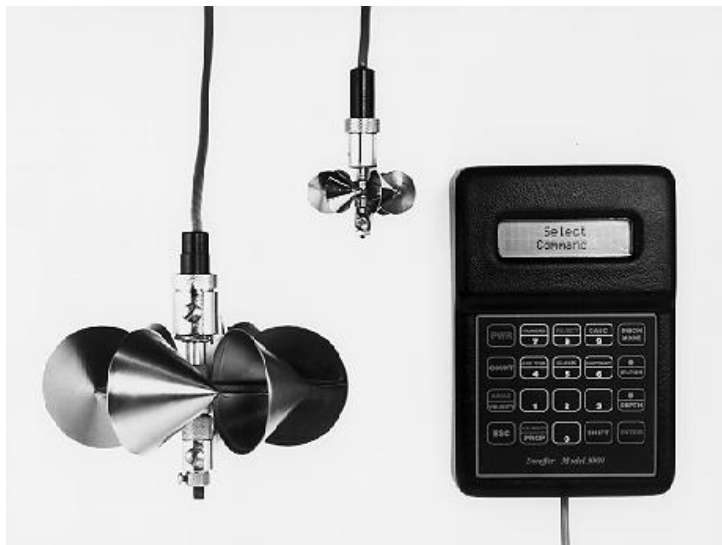


Fig. 1

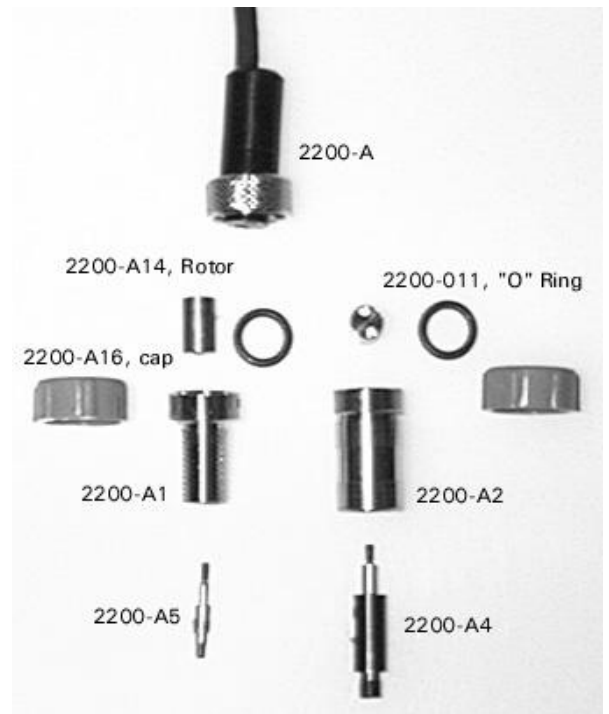
## MODEL 2200-3000 PARTS LIST

PART NUMBER	DESCRIPTION	QUANTITY
2200-A	Sensor-cable assembly, 10'	1
3000 Indicator	Digital readout indicator	1
2200-A1	Sensor adapter, Pygmy meter	1
2200-A2	Sensor adapter, AA meter	1
2200-A4	Replacement Rotor Shaft, AA meter	1
2200-A5	Replacement Rotor Shaft, Pygmy meter	1
2200-011	"O" Ring seals, (2 spares also provided)	4
2200-A14	Fiber-Optic Carrier Rotors	2
2200-A16	Adapter protection Caps	2
.05" Allen wrench	Used as Rotor Installation Wrench	1
10-32 X ¼" Screw	Replaces cat-whisker contactor PYGMY meter only	1
NECK STRAP	Snap swivel for attachment to Indicator back	1
CHEST-WAIST HARNESS	For hands free use of the 3000 Indicator	1
AA BATTERIES	One set (4) required for operation plus a spare set	2
CD-ROM	IBM PC compatible only, file transfer software, etc.	1
USB cable	Interface cable for pc USB port-to-M3000 meter	1
INSTRUCTIONS	FOR OPERATION AND MAINTENANCE	1 Set

## SENSOR ADAPTER INSTALLATIONS (refer to drawings in back)

### AA METER

1. Remove contact chamber assembly entirely.
2. Remove pivot shaft from yoke at lower end of the bucket wheel.
3. Unscrew and remove upper rotor shaft from the bucketwheel and replace it with part 2200-A4. Carefully mate the threads of the new shaft to the bucketwheel threads and tighten shaft **ONLY** with the .05" Allen wrench inserted in the wrench hole in the shaft (to prevent damage to the bearing surfaces).
4. Install Sensor Adapter (2200-A2) through the top of the yoke, carefully inserting the upper portion of the new rotor shaft through the hole in the bottom of the adapter. When seated, the AA adapter should be locked in place by tightening the front yoke screw. *See AA Meter Retrofit Problems ahead for fit detail and possible problems with installation of this component.*
5. Re-install the lower (pivot) shaft and adjust vertical position of bucketwheel as necessary.
6. Using the brass blade driver supplied install the Fiber-Optic Carrier Rotor (2200-A14) through the top of the Adapter and onto the threads of the new rotor shaft. **DO NOT TIGHTEN TOO TIGHT TO AVOID STRIPPING THREADS.** The top of the Fiber-Optic Rotor must not be above the shoulder inside the Adapter. See step 4.



7. Conduct the standard AA meter spin test as defined by the USGS instructions. When properly installed and adjusted, the AA meter conversion should provide at least a slight increase in the normal spinning time.
8. Install the "O" Ring (2200-011) in the top of the 2200-A2 Adapter.
9. Place the Sensor (2200-A) on the adapter and tighten the sensor mounting nut (2200-A3) finger tight only. The sensor should not rotate when mounting nut is tightened. If it does tighten the front yoke screw a bit more (see step 4 above) and check that the "O" ring is properly seated.
10. Give the meter a second spin test to make sure all installations are correct and that operation is satisfactory.

## **PYGMY METER**

1. Remove contact chamber cap, binding post nut and binding post body, leaving only the nylon bushing in place in the yoke. Install the furnished **10-32 x 1/4"** screw tightly in the bushing.
2. Remove the bucketwheel pivot shaft.
3. Unscrew the upper rotor shaft from the bucketwheel and replace it with the new one (**2200-A5**). Tighten the new shaft only by using the wrench (**.05" allen wrench**) inserted in the hole in the rotor shaft to avoid damage to the bearing surface.
4. Remove Upper Bearing (bronze part) from the yoke. This part is not necessary and will prevent proper installation of the adapter if not removed.
5. Install the Pygmy meter Adapter (**2200-A1**) by threading it into the upper yoke arm (formerly the contact chamber cap threads). Carefully insert the top of the new bucketwheel shaft through the hole in the adapter bottom while you thread. Tighten the adapter onto the yoke by use of the allen wrench horizontally through the holes in the upper threads of the adapter. Make sure the adapter is tight to the yoke otherwise removal of the sensor nut may unscrew the adapter if the threads are a bit snug.
6. Re-install the lower pivot shaft adjusting it vertically as necessary; centering the bucketwheel in the yoke as much as possible.
7. Using the brass blade driver supplied install the Fiber-Optic Carrier Rotor (**2200-A14**) through the top of the Adapter and onto the threads of the new rotor shaft. **DO NOT TIGHTEN TOO TIGHT TO AVOID STRIPPING THREADS. The top of the Fiber-Optic Rotor must not be above the shoulder inside the Adapter.**
8. Conduct a spin test. When properly installed and adjusted, the spinning time should be at least as long as that previously achieved before conversion. Note the rotation of the fiber-optic rotor. It should be in the center of the adapter and must never come in contact with the sides of the adapter. *See Pygmy Meter Retrofit Problems, ahead, and refer to the notes for corrections if contact is being made. Do not operate the meter if fiber-optics rotor makes contact with the adapter!*
9. Install the "O" Ring (**2200-011**) in the top of the Adapter and place the Sensor on the Adapter and tighten the Sensor Retaining Nut (**2200-A3**) on the yoke finger tight only. Do not operate the sensor without an "O" ring as it helps keep the optics from contacting the rotor should tolerances be wrong.
10. Conduct a second spin test to confirm all installations and adjustments are satisfactory.

**NOTE:** *Keep the adapter protectors (**2200-A16**) on the meters when the instrument is not in use. These protect the adapter threads, prevent loss of the "O" rings and keep dirt out of the sensor.*

## **CARE AND MAINTENANCE OF THE MODEL 2200-3000 SENSOR**

1. The proper operation of the Model 2200 Sensor depends on the transmission of an infrared light beam generated by the light-emitting diode in the Sensor through 180° loops of rotating fiber-optic bundles

to the photo-sensitive transistor. If the fiber-optics or the LED and transistor are allowed to get too dirty, light transmission will be impeded. Periodically check the fiber optic rotor (**2200-A14**) and wash the ends of the optics in clear water. Soap and water may be used if surfaces are very dirty. Do the same for the LED and Photo-Transistor in the Sensor body. CAUTION: Do not scratch the surfaces of the LED and Photo-Transistor.

2. Regularly clean out and re-lubricate (use same type oil as originally supplied with your meters) the inside of the sensor adapter chamber where the rotor turns and also check for bearing wear between the chamber and the upper rotor shaft. If side to side play is excessive rotate the Adapter  $\frac{1}{4}$  turn and check side play again. Replace the Adapters (**2200-A1**, Pygmy & **2200-A2**, AA) if play is excessive or vibrations occur which cannot be corrected by adjustments or lubrication.

## APPLYING CALIBRATION CORRECTIONS TO THE MODEL 2200-3000

The default Calibration Numbers (Props 4 and 5) for the Model 2200-3000 are for the "Velocity" reading and "Disch Modes" only and are for USGS Price Meters which are "standard rated" (Prop 4 is the AA meter and Prop 5 is the Pygmy meter). Damage to the bucketwheel cups, maladjustments and excessive bearing wear will influence this rating as will meters not produced to U.S. Geological Survey specifications.

It is possible, using the Model 2200-3000, to change the calibration and compensate for some types of damage to a Price Type meter and still obtain accurate velocity data. It must be recognized however, that any damage to a meter other than minimal bucketwheel cup damage (bent or dented slightly) should NOT BE COMPENSATED FOR. The meter itself should be reconditioned with new parts and re-rated in the normal manner before use with the Model 3000 Indicator.

See the Model 3000 Indicator operating instructions for further information on calibration and calibration corrections.

## AA METER RETROFIT PROBLEMS

1. In **some** AA Yokes it has been found that a deep chamfer has been made in the hole through the top of the Yoke. The chamfer has no effect on the original Catwhisker contactor's fit but it can **seriously effect the positioning of the Swoffer adapter**. If the chamfer is deep enough it can allow the **2200-A2** adapter to drop too low around the **2200-A4** shaft and cause clearance problems between the Adapter, the Shaft, the Fiber-Optics Rotor (**2200-A14**), and the Sensor (**2200-A**). **The threaded portion of the adapter must not drop below the top level of the AA yoke.**
2. Swoffer has produced special tapered washers for some customers with incorrectly machined yokes but it is impossible to predict in advance the amount of any yoke's chamfer since **a chamfer is not called out on USGS drawings**. The chamfer is entirely at the discretion of the machinist. If you do have an excessive chamfer in your Yoke you can hold the Adapter in the correct position (the bottom of the threaded section of the Adapter exactly even with the top flat surface of the AA Yoke) while tightening the set screw on the front of the Yoke. If the set screw is kept snug then operation without a shimming washer can be very satisfactory.

## PYGMY METER RETROFIT PROBLEMS

In some Pygmy (mini) meters the holes through the upper and lower yokes are not concentric. This condition does not effect the original catwhisker operation so these meters may have been in the field for years operating without problems. **But** a non-concentric condition will seriously affect the fit and function of the Fiber-Optic rotor when installation is attempted on an out-of-tolerance Pygmy yoke.

While installing, if the fiber-optics rotor contacts the inside of the Adapter anywhere during rotation then immediately and carefully remove the kit parts entirely. The Pygmy yoke must then be adjusted or replaced before re-installation of the fiber optic sensor adapter kit is attempted. Call Swoffer Instruments, Inc for help in this regard. (206) 575-0160.

## QUICK OPERATING INSTRUCTIONS FOR THE MODEL 2200-3000

1. Connect 2200 Sensor cable to the Model 3000 Indicator by use of the twist-lock connector.
2. Attach the Sensor to a meter using the knurled slip ring. Check that the bucket wheel rotates freely and that the fiber-optics rotor does not contact the sensor or the adapter.
4. Choose the Prop (calibration number appropriate for the sensor-meter combination you have connected to the Indicator). Normally it will be Prop 4 or 5. (4=AA, optic, 5=Pygmy, optic).
5. Place the Indicator in the Count mode and spin the meter to be sure that the sensor is producing pulses. With the normal "two hole" fiber-optic rotor you should get two pulses per meter revolution. If confirmed then:
6. Choose the operation desired by use of the key pad. (Count Revolutions, Velocity, or Discharge Mode).
7. Place the meter in the stream and begin taking readings.

NOTE: A separate section of the instructions refers to the Model 3000 Indicator. In most cases references to the 2200 portion of the instrument is either not necessary or is implied since the Model 3000 instrument was designed to operate with many different kinds of sensors including the "2200" version for Price Type meters with optic sensors.

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### AA Meter Optical Retrofit

