DESCRIPTION AND INSTRUCTIONS FOR OPERATION

Although titled a "current meter", the Model 2200 is actually a retrofit sensing and readout device 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 many years yielding reasonably accurate current velocity data by timed counting of "bucket wheel" revolutions. Bucket wheel construction is closely controlled and standard rating tables of velocity as a function of revolutions and time are published by the USGS. The usual method of counting 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. 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 constant maintenance and careful adjustment of the delicate "cats-whisker" contactors and proper lubrication of bearings and gears. The operator must also coordinate the start and stop of the timing device while accurately counting the meter revolutions. Even with regular maintenance and the proper adjustments and operating procedures the Price Meters are not considered reliable 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 sensor for the Model 2200 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 which completely replaces the contact chamber assembly (AA Meter) and the cats-whisker contactor (Pygmy Meter). Rotational friction is brought to a minimum and accurate readings down to and below 0.5 foot per second are attainable using the optical retrofit sensor.

Once the sensor adapters are installed on the AA and Pygmy meters the Model 2200 Photo-Optic Sensor can easily be placed on either meter as desired. The Indicator will then provide stream velocity readings in any of several modes:

1. Direct velocity reading with resolution to tenths of feet per second using an AA meter.

2. Direct reading of velocity with resolution to tenths of feet per second using a Pygmy (Mini) meter.

3. Simultaneous display of elapsed time in seconds against actual meter revolutions. Either style meter may be used and velocity is determined by use of the Standard Rating Tables.

4. Meter revolutions alone can be counted to 9,999. When used with a user supplied stopwatch, long averaging periods can be measured which is helpful when the stream is extremely turbulent. The Standard Rating Tables are also used when the Indicator is operated in this mode.

5. An audio output signal is generated in an earphone at each completed meter revolution. This signal is an electronic "beep" and functions in any mode except OFF. Counting beeps along with use of a stopwatch and the Rating Tables will yield velocity. This function has been provided to assure the operator that the meter is in fact rotating should it be employed in deep or murky water out of the operator's sight.

MODEL 2200 PARTS LIST

PART NUMBER	DESCRIPTION	QUANTITY
2200-A	SENSOR/CABLE ASSY, 11' CABLE	1
2200-B	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
$^{1}/_{32}$" Allen Wrench	SENSOR INSTALLATION WRENCH	1
2200-011	"O" RING SEALS, (2 SPARES INCLUDED)	4
2200-A14	FIBER-OPTIC CARRIER ROTOR	2
2200-A16	ADAPTER PROTECTION CAP	2
10-32 X ¼" SCREW	REPLACES CATS-WHISKER CONTACTOR, PYGMY	1
NECK STRAP		1
9 VOLT BATTERIES	(ONE ADDITIONAL SUPPLIED AS A SPARE)	2
INSTRUCTIONS FOR OPERATION AND MAINTENANCE		1 SET

SENSOR ADAPTER INSTALLATIONS

AA METER (see important notes page 10)

1. Remove contact chamber assembly.
2. Remove pivot shaft from yoke at lower end of the bucket wheel.
3. Unscrew and remove upper rotor shaft of 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 allen wrench and 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 snugging the front yoke screw. **See last page for fit detail and possible problems with this installation.**
5. Re-install the pivot shaft and adjust vertical position 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 Adapter.
9. Place the Sensor **(2200-A)** on the adapter and orient the cable so that it streams aftward on the yoke (only if you have a 90° sensor cable). Tighten the sensor mounting nut **(2200-A3)** finger tight only. The sensor should not rotate when mounting nut is tightened. If it does see step 4 above.
10. Give the meter a second spin test to make sure all installations are correct and that operation is satisfactory.

PYGMY METER (see important notes page 11)

1. Remove contact chamber cap, binding post nut and binding post body, leaving only the nylon bushing in place. 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 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 for operation.
5. Install the Pygmy meter Adapter **(2200-A1)** by threading it into the upper yoke arm (formerly the contact chamber cap threads). Carefully inserting the top of the new bucketwheel shaft through the adapter while threading. Tighten the adapter onto the yoke by use of the allen wrench and the holes through the upper threads of the adapter. It is not necessary to tighten excessively.
6. Re-install the lower pivot shaft and adjust as necessary.
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.
9. Install the "O" Ring **(2200-011)** in the top of the Adapter and place the Sensor on the Adapter so that the cable streams aftward on the yoke. Tighten the Sensor Retaining Nut **(2200-A3)** on the yoke finger tight only.
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 bearing surfaces.*

MODEL 2200 INDICATOR PREPARATION AND CHECKOUT

1. Remove the back of the Indicator (4 knurled thumb screws) and connect a 9 volt battery to the battery terminal if the display doesn't respond when you rotate the selector switch from the **OFF** position. Replace caseback.
2. Connect the Sensor **(2200-A)** to the Indicator via the twist-lock connector and place the Sensor on one of the converted Price Meters.
3. Rotate the Indicator Selector Switch to **REVOLUTIONS** and give the meter a spin by hand. Press and release **START/STOP** and the Indicator will begin to count meter revolutions. This counting will continue until **START/STOP** is pressed again, at which time the display will "hold" the elapsed counts. Pressing **RESET** will return the display to 0000.
4. Rotate the Selector Switch to **SEC:REV** (Seconds:Revolutions) and give the meter a spin. Press and release **START/STOP** and at the next sensor output signal the left hand two digits will begin counting elapsed time in seconds and the right hand two digits will begin counting revolutions. This counting will continue until **START/STOP** is again pressed. The display will stop counting at the next completed revolution after **START/STOP** is pressed this second time. Data will remain on the display until **RESET** is pressed.
5. Insert the earphone jack in the socket located at the bottom end of the Indicator. With the Meter spinning and the Selector Switch in any position except **OFF**, a "beep" tone can be heard in the earpiece at each completed revolution. **START/STOP**, **RESET** or any other function switch position will not effect the beeper. Only removal of the earphone from the jack or switching the Indicator to one of the **OFF** positions will stop the tone.

The procedures above check out the sensor circuitry and the basic Indicator functions. To confirm proper calibration of your Model 2200 in the DIRECT VELOCITY READING MODES YOU SHOULD COMPLETE THE FOLLOWING:

1. Rotate the Selector Switch to **VELOCITY AA**, spin the meter and press and release **START/STOP** and **RESET** in that order. (Since actual velocity readings are not being taken at this time either meter may be used for this Indicator demonstration). In approximately ten seconds from the release of the **RESET** button a figure will appear in the display. This figure will be the stream velocity to tenths of feet per second AVERAGED over the 10 second timing period. The figure will remain in the display until the completion of the next timing period when it will display the AVERAGE VELOCITY for **that** period. This cycle repeats continuously. **NOTE**: The display shows only the velocity average for the previous timing period. It does not accumulate the average.

2. Rotate the Selector Switch to **VELOCITY PYGMY** and repeat the same procedure. Operation is the same as in the **VELOCITY AA** position except that the averaging time period is approximately 5 seconds instead of 10 seconds.

CALIBRATION CONFIRMATION

1. Rotate the Selector Switch to the **CHECK CALIB** position.

2. Press and release **START/STOP** to initiate indicator circuitry.

3. Depending on the style of meter you are checking, press and HOLD IN the button marked **AA** or **PYGMY**. Press and release **RESET** and a figure will appear in the display. This figure is the "Calibration Number" held by the indicator for that particular meter. (You must keep pressure on the button to view the CAL NO.) The CAL NUMBERS SHOULD BE:

AA = 920
PYGMY = 2036

In order for the Model 2200 Indicator to produce accurate readings in the Direct Velocity modes the figures held by the Indicator should be kept as close as possible to those noted above. Percentage of error in readings due to indicator calibration is directly proportional to the percent difference between the ideal numbers shown above and the numbers the indicator holds for the meters.

The Calibration Numbers represent the frequency of an adjustable oscillator in the indicator circuitry. The oscillator frequency can be changed by use of the **CAL ADJUST** screws located at the bottom end of the indicator. The adjustment potentiometer screws are accessed by **removing** the black plastic screws and using a jeweler's screwdriver. The adjustment pots are 15-turn cermet type. Clockwise rotation of the adjustment screws will increase the Calibration Number value displayed. (Remember that the pushbutton must be kept held in when making adjustments).

Besides being influenced by the adjustment pots, the Calibration Numbers in the display are also affected by the strength of the battery. As the battery voltage drops with use so will the Calibration Numbers. Down to about 6 volts the CAL Nos. can still be adjusted upward to normal, but below this voltage they cannot. Replace the battery as soon as the CAL Nos can no longer be brought up.

Should you find yourself in the field and the battery is too low to bring up the CAL Nos., switch to one of the other modes (**SEC:REV**, **REVOLUTIONS**) to find velocity. The Model 2200 Indicator will operate with lower battery voltages in these other modes.

OPERATING INSTRUCTIONS FOR THE 2200 RETROFIT CURRENT METER

DIRECT VELOCITY READING-USING THE AA METER

1. Rotate selector switch to **VELOCITY AA** (marked in red on left side of dial).
2. Place the Sensor on the AA meter and connect cable to Indicator.
3. Orient AA meter in the stream as normal.
4. Press and release **START/STOP** and **RESET** (in that order).
5. In approximately 10 seconds the average stream velocity for that 10 second timing period will be displayed. Every 10 seconds thereafter the display will update with new averaging data. Remember that the display does not show accumulated averages but only the average velocity of the previous 10 second timing period.
6. Pressing **START/STOP** anytime after the cycle has begun will stop the process and the display will hold the last figure shown.
7. Pressing **RESET** after step 6 will return the display to 0000. Pressing reset **before** step 6 will zero the display and return the timing cycle to "time zero". Averaging cycle will commence immediately upon release of the **RESET** button.

DIRECT VELOCITY READING-USING THE PYGMY METER

1. Rotate selector switch to **VELOCITY PYGMY** (marked in yellow on right side of dial).
2. Place the Sensor on the Pygmy meter and connect the cable to the Indicator.
3. Orient Pygmy meter in the stream as usual.
4. Press and release **START/STOP** and **RESET** (in that order).
5. In approximately 5 seconds the average stream velocity for that 5 second timing period will be displayed. Thereafter the display will update every 5 seconds. Remember that the display does not show accumulated averages but only the average velocity for the latest timing period.
6. Pressing **START/STOP** anytime after the cycle has begun will stop the process and the display will hold the last figure shown.
7. Pressing **RESET** after step 6 will return the display to 0000. Pressing reset **before** step 6 will zero the display and return the cycle time to "time zero". The cycle will commence immediately upon release of the RESET button.

VELOCITY DETERMINATION USING "SEC:REV" (USE Standard Rating Tables)

1. Rotate selector switch to **SEC:REV**. Press and release **RESET** if the display does not read 00:00.
2. Connect the Sensor to the Indicator and place the Sensor on the meter to be used, AA or Pygmy.
3. Orient the meter in the stream in the normal way.
4. Press and release **START/STOP**. At the next sensor output signal the Indicator will begin counting time in seconds (left side of the colon) and meter revolutions (right side of the colon).
5. When the desired sampling time (or number of revolutions) is reached (see note below), press **START/STOP** again. The display will stop counting **at the next completed**

revolution after **START/STOP** was pressed. Data will remain in the display unless **RESET** is pressed.

NOTE: If the last counted revolution **does not occur** after **START/STOP** has been pressed (if the meter rotation is stopped for some reason), then the seconds will continue to count and data for that timing period will be in error. The timing cycle is **synchronized** with the first count after **START/STOP** begins and with the first count after **START/STOP** is pressed a second time to end the cycle.

NOTE: It will take some practice on the part of the operator to get the meter so stop on an exact number of seconds (20, 40, etc.) since the Model 2200 counting circuitry is synchronized with meter revolutions rather than seconds. Counting seconds will not stop until the next revolution after START/STOP is pressed.

6. Use the USGS Standard Rating Tables for Price Type Current Meters to determine velocity.

7. Press and release **RESET** to return the display to 00:00.

VELOCITY DETERMINATION USING "REVOLUTIONS"

1. This method requires an user-supplied stopwatch and the Standard Rating Tables.

2. Rotate the selector switch to **REVOLUTIONS**. Press and release **RESET** if the display does not read 0000.

3. Connect Sensor to the Indicator and place Sensor on the meter.

4. Place the meter in the stream as normal.

5. Press and release **START/STOP at the same instant** that you start your stopwatch. When the desired amount of time (or revolutions) has elapsed, press and release **START/STOP** again and stop your stopwatch simultaneously. The display will hold the counted revolutions until **RESET** is pressed.

6. Use the USGS Standard Rating Tables to determine velocity.

MODEL 2200 INDICATOR FUNCTION SWITCH... DEFINITIONS

START/STOP — Initiates all functions (except earphone tone) of the Indicator. Must be pressed each time the Rotary switch position is changed to start functions. Pressing during any function will stop tabulation and the display will "hold" the most recent data.

OFF/OFF — Cuts power from battery to Indicator circuitry and the Sensor (when connected to indicator). Both **OFF** positions are the same.

VELOCITY AA — Indicator provides velocity readings in feet per second to tenths with a display update time of about 10 seconds. Data is valid only if used on the AA meter.

VELOCITY PYGMY — Indicator provides velocity in FPS to tenths with display update time of about 5 seconds. Data is valid only when used with a Pygmy meter.

SEC:REV — **SECONDS** vs **REVOLUTIONS**. Changes the display format to 00:00 with the left hand digits representing elapsed time in seconds and the right hand digits representing the meter revolutions. "Time start" and "time stop" are synchronized to activate at the first meter revolution after **START/STOP** is pressed once and the first revolution after **START/STOP** is pressed a second

time. Both the seconds and the revolutions will continue to count through 99 if not stopped beforehand.

REVOLUTIONS Display format is 0000. Counts meter revolutions through 9,999 unless stopped beforehand. Normally used with an user supplied stopwatch.

RESET Used to reset the display and timing cycle to zero. Should be used before any cycle if the display does not show zeros. If activated before **START/STOP** is used to end any cycle, the display will go to zero and immediately begin its timing cycle over again. Should not be used in this manner when the indicator is in the **SEC:REV** mode because it will not allow synchronized starting of the timing with the revolution counts.

CHECK CALIB. With the switch in this position use the right and left hand pushbuttons (marked **AA** and **PYGMY**) to display the Calibration Number held by the indicator. Press and release **START/STOP** then hold down the button of the Meter Cal No. you wish to see.

AUDIO OUTPUT This function is not labeled on the Model 2200 Indicator. When an earphone is connected to the phone jack (at bottom end of the indicator) an audible "beep" tone is heard at the completion of each meter revolution. The tone is not affected by any other function of the Indicator except OFF. Used primarily when the meter is out of sight of the operator to confirm that the meter is rotating.

CARE AND MAINTENANCE OF THE MODEL 2200 INSTRUMENT

SENSOR:

1. The proper operation of the Model 2200 Sensor depends on the transmission of an infrared light beam generated by the light-emitting diodes in the Sensor through 180° of rotating fiber-optics bundles to the photo-sensitive transistor. If the fiber-optics and or the LED and transistor are allowed to get too dirty, light transmission will be impeded. Periodically check the fiber optic carrier 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. Periodically clean out and lubricate (use same oil originally supplied with your meters) the inside of the sensor adapter chamber where the carrier 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 ¼ turn and check side play again (applicable only with the AA Adapter, 2200-A2). Replace the Adapters (**2200-A1**, Pygmy & **2200-A2**, AA) if play is excessive or vibrations occur during rotation which cannot be corrected by adjustments or lubrication.

INDICATOR:

1. The Model 2200 Indicator is water-resistant only but will float if accidentally dropped into the stream. The battery compartment is not sealed against moisture and water will accumulate in the compartment if immersed or held upside down in the rain. If the battery compartment gets water in it dry all electrical connections as soon as possible after use and disconnect the battery. The foam liner is "closed cell" and will not absorb moisture except on its surface. Allow to dry in the open air with the back of the Indicator open if possible. Do not store the indicator in a damp condition.

2. The electrical cable connector is water-resistant only when mated. Should the connectors become wet during the day's use, clean and dry them as soon as possible. The contacts are gold plated so no corrosion will occur at the mating surfaces.

3. The Indicator viewing lens is acrylic and will scratch very easily if contacted with sharp or abrasive materials. To clean the Indicator and lens use a soft cloth and anti-static cleaner solution clearly marked for use on plastics (ABS, Polycarbonate, and Acrylic). Armor All cleaner works well.

BATTERY:

1. The Model 2200 requires a 9 volt DC power source. The indicator is set up for the transistor style battery and the alkaline type lasts longest. Space is provided in the compartment for a spare battery.

2. Battery life, of course, depends on the extent of use of the Model 2200. When not taking readings be sure to turn the selector switch to one of the **OFF** positions to preserve the battery charge.

3. A weakened battery has little effect on all modes of the Indicator except the Direct Velocity Reading modes. The Calibration Number for use by the Indicator in this mode depends on a close-to-full power battery. Always keep fresh spares on hand.

APPLYING CALIBRATION CORRECTIONS TO THE MODEL 2200

The Calibration Numbers given for the Model 2200 are for the Direct Velocity Reading modes only and are for USGS Price Meters which are "standard rated". 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, to 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 should be reconditioned with new parts and re-rated in the normal manner before use.

The recommended Calibration Numbers are the frequencies of an adjustable oscillator in the circuit for the Direct reading of velocity. Because of the way the Model 2200 counts and stores sensor output pulses (two per meter revolution), these Calibration Numbers can also be thought of as the number of revolutions which would occur if the meter were towed through the water over a distance of 2000 feet. Using the Indicator's ability to count meter revolutions, it is possible to walk the meter through a measured length course and count the resulting revolutions. After calculating the number of revolutions the meter would turn if the course were 2000 feet long, it is easy to modify the Calibration Number held by the Indicator, thereby applying calibration "corrections" to the Model 2200.

METHOD:

To use the above method of calibration you will need an area of still water along which you can walk while "towing" the meter. The meter is placed on a wading rod or top-setting rod and connected to the Model 2200 Indicator and Sensor in the normal manner. Walk along the course at a speed close to the velocity you are most concerned with measuring. The longer the course length the better will be the results of your calibration efforts. Fifty feet is about minimum although distances as short as 25 feet will work. The waterway should be deep enough and quiet enough to minimize any outside influence on revolutions.

1. Begin by laying a tape measure alongside the course. Place the tape as close to the water's edge as possible.

2. Next place the meter, suspended on the rod, in the water a few feet before the beginning of the course. Be sure to hold the rod vertical throughout this procedure.

3. Switch the Indicator to the **REVOLUTIONS** position. Begin walking the course and press and release **START/STOP** as the wading rod enters the course. (Use the rod instead of the meter itself as its position is easier to judge against the tape measure). The Indicator will count a revolution at the next sensor output signal after **START/STOP** was pressed.

4. An assistant will come in handy here. At this first revolution count the assistant should mark the spot on the tape where it occurred while you continue to walk the course.

5. Somewhere near to the end of the course (tape length) but not **before** the end of the course, press and release **START/STOP** again and continue walking. At the next completed revolution after you pressed **START/STOP** the Indicator will stop counting revolutions. Have the assistant mark this location on the tape also. The indicator will now be showing the revolutions between the marks. Take the measurement between the marks.

6. Make several passes through the course in both directions, recording revolutions and measurements. Compute the average course length and number of revolutions then compute the average number of revolutions per foot by the formula:

$$\textbf{Rev per Foot} \quad \frac{\mathbf{N}}{\mathbf{D}}$$

Where **N** = Number of revolutions & **D** = Distance in feet.

7. Multiply revolutions per foot by 2000 and round to the nearest whole number. This is the CALIBRATION NUMBER for the meter. If it is different from that recommended by SWOFFER then it is possible that you do not have a standard rated meter. This new figure should be placed in the Model 2200 by use of the **CAL ADJUST** screws located at the bottom end of the Indicator.
NOTE: When adjustments to the Calibration Number are made because of a non-standard or damaged meter only readings taken with the Model 2200 in the Direct Reading Mode can be used. Remember that since the meter is not "standard" the Rating Tables will not be accurate with your meter.

8. The Calibration Numbers can be changed by use of the **CAL ADJUST** screws located at the bottom end of the Indicator. Rotate the switch to **CHECK CALIBRATION** and press and release **START/STOP**. Hold down the appropriate CAL button and the CAL NUMBER that the indicator presently holds will appear in the display. If you are changing the CAL No. remove the Cal Adjust Cover Screw(s) from the bottom of the Indicator.
Carefully insert a jeweler's type small screwdriver and rotate the adjustment screw until the figure in the

display is within 1% of the desired Cal No. **Clockwise rotation of screw increases the figure** and remember you must continually hold down the AA or Pygmy button while making adjustments or the display will read only zeros. BE SURE TO REPLACE THE CAL ADJUST COVER SCREWS AFTER MAKING CORRECTIONS. THESE COVER SCREWS PROVIDE DIRECT ACCESS TO THE CIRCUIT BOARD AND WILL ALLOW WATER TO SHORT-CIRCUIT THE BOARD IF LEFT OFF OR LOOSE.

9. Battery condition will effect the value of the Calibration Numbers. As battery voltage drops the Cal Nos. will also drop. Check the Cal Number regularly during use, keep fresh batteries on hand, and remember that errors in readings due to Calibration Number errors are in direct percentage proportion to the difference between what the Calibration Number **should be** and what is displayed by the Indicator.
If the AA meter needs a Cal Number of 920 and the Indicator shows that the Cal Number it is using is 915 then the error is 0.5%.

Some Helpful Operating Hints

1. Each time the rotary switch is moved from one position to another you must push **START/STOP** to reactivate the function. This can be helpful if a sequence of pushbuttons is in doubt. Simply rotate the selector to any other position then back, press **START/STOP**, and begin the sequence again.

2. Treat the Pushbuttons very gently. Only slight pressure is required for their operation and, as in case of the **RESET** button, the action activated by the buttons will not initiate until the button is released.

3. Confirm the Calibration Number often while measuring in the direct reading mode. If it is different from what it should be adjust it as soon as possible but know that alterations to the data can be made after the fact by applying the percentage difference between the correct number and the incorrect number to the indicated velocities.

AA Meter Retrofit Problems

1. In **some** AA Yokes it has been found that a deep chamfer has been made in the hole at the top of the Yoke. The chamfer has no effect on the Catwhisker contactor's fit but it can **seriously effect the positioning of the Swoffer adapter**. If the chamfer is deep enough it will allow the Swoffer **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 adapter must not drop below the level indicated in the last drawing of these instructions**.

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 who originally made it.
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 Yoke. If the set screw is kept snug then operation can be very satisfactory.

Pygmy Meter Retrofit Problems

1. 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 some of these meters may have been in the field for years working without problems. **But** a non-concentric condition will seriously effect the fit and function of the Fiber-Optic rotor when installation is attempted on an out-of-tolerance Pygmy yoke.
2. After installation, 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 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

1. Connect 2200 Sensor to the indicator by use of the twist-lock connector.

2. Attach Sensor to the Meter, orienting cable to the rear. Check that the bucket wheel rotates freely.

3. Rotate indicator selector switch to **REVOLUTIONS**, spin bucketwheel and press and release **START/STOP**. Confirm that the indicator is counting bucketwheel revolutions.

4. Rotate selector switch to **CHECK CALIB**. Press and release **START/STOP**. Press and hold in the **AA** button. The Calibration Number should be **920** for a standard rated **AA** meter. Adjust the number if desired by use of the **CAL ADJUST** screws located underneath the outer plastic screws at the bottom end of the Indicator. Do the same for the Pygmy meter Cal Number which should be **2036**.

5. Place the meter in the stream and select the method of measuring desired by use of the selector switch.

6. Check calibration number often when using the Model 2200 in the direct reading mode.

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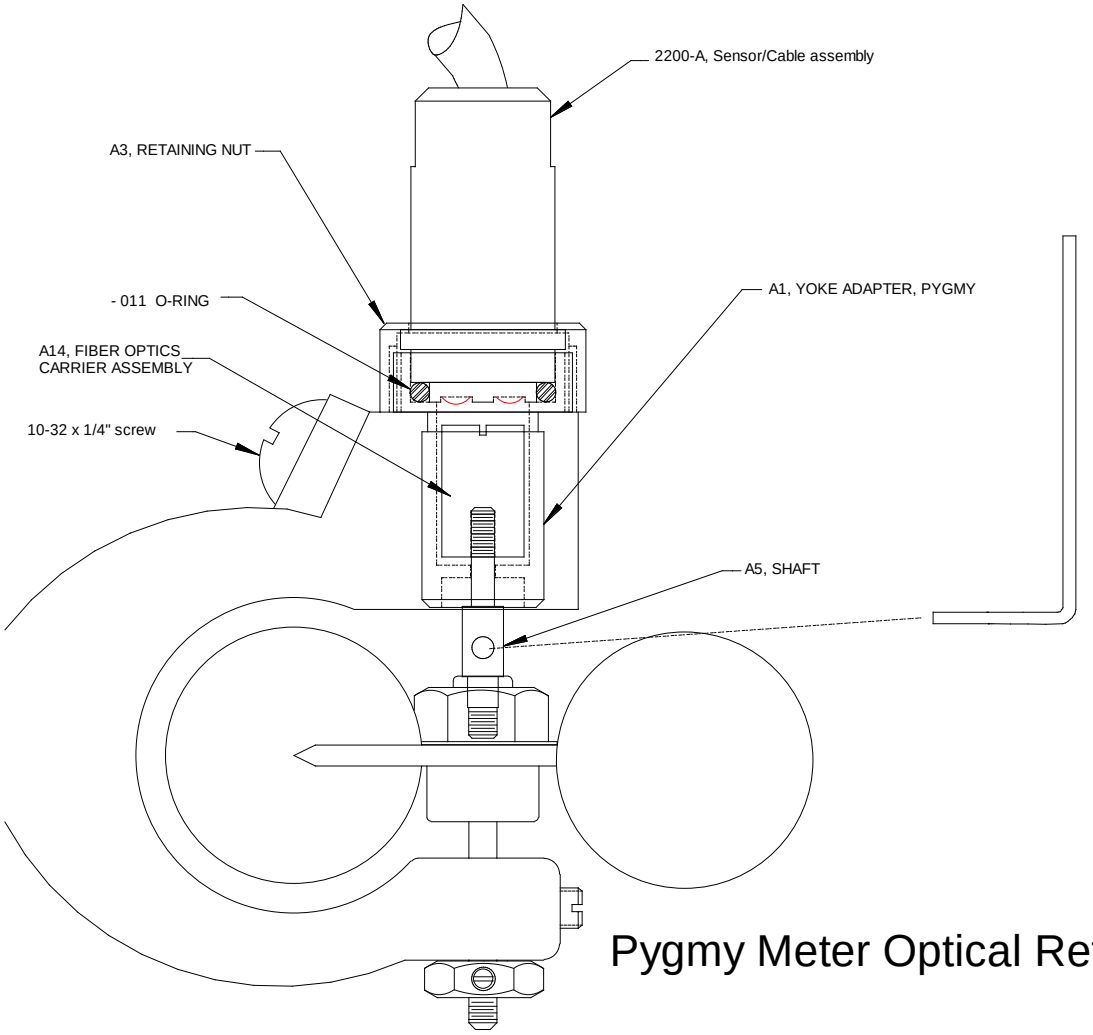

Pygmy Meter Optical Retrofit

AA Meter Optical Retrofit