

Marketing Memo

Compound Meters – Practical Solutions for Measurement Problems Reasons for Sensus Meters by Steve McCoy, Marketing Manager

The history of the compound meter goes back many years and includes a number of changes and improvements along the way. Although several meter companies manufacture compound meters and the American Water Works Association (A.W.W.A.) has adopted standards covering their measurement performance, design variations have resulted in a variety of approaches.

At Sensus, our experience in designing and refining today's SRH Compound Meter draws upon lessons learned from more than 125 years of quality meter manufacturing. In fact, it is the application of modern technologies which enables us to design and produce a compound meter that is far superior to those produced only a few years ago - one that provides long lasting measurement accuracy and plenty of dependable service.

Compound Meter Standards

The A.W.W.A. has developed and adopted a very reasonable guideline for most manufacturers with respect to compound water meters. The current standard C702 has been reviewed and refined many times. In spite of the refinements and updates, there is an ongoing controversy in how these large revenue producing meters should be used.

As the name denotes, a compound meter consists of two measuring chambers housed in a single meter body or assembly. One chamber is intended to capture all the water passing through the meter at low flows while the other is positioned to measure all high flow consumption of the service.

Sensus SRH Compound Meters continue to meet or exceed all requirements in the A.W.W.A. Meter Standard C702 as most recently revised.

Meter Applications

The following guidelines are universal for most compound meters and should be considered when installing Sensus Compound Meters.

Do use a compound meter in -

- Applications "where people are living" or similar settings such as apartment buildings, mobile home parks, hotels, motels, schools, etc.
- Extremely wide flow range applications; from drips to high flows
- Clean, cold water applications only
- Horizontal and plumb installation settings only
- Service connections not requiring a fire service rating
- Applications where the cost of the water justifies a full range meter cost
- Applications where the majority of the typical flows are low to medium with only occasional high flows

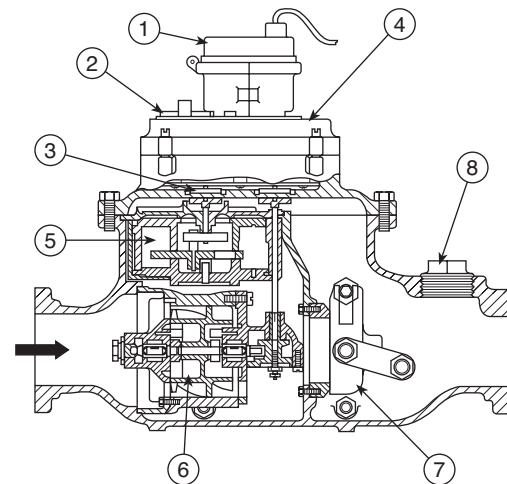
Do not use a compound meter in -

- Dirty or non-potable water conditions (Propeller Meter recommended)
- Extreme, continuous high flow service conditions (Turbo Meter recommended)

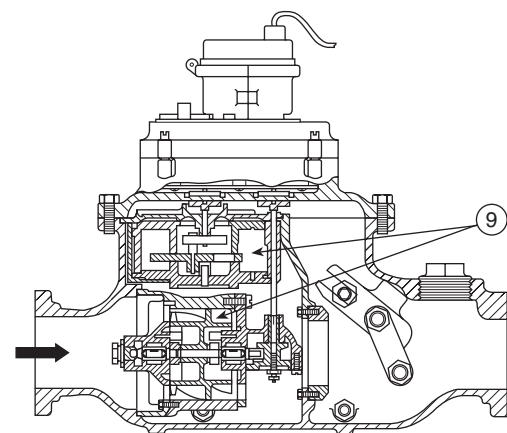
- A fire service rating application (FireLine® Assembly or Turbo Meter with UL/FM strainer)
- Any typical irrigation service (Propeller Meter or Turbo Meter recommended)

Features And Benefits

The following is a review of each Sensus Single Register High Performance (SRH) Compound Meter component. This review also presents the performance benefits you can expect along with alternative designs utilized by other manufacturers and suppliers of compound meters.



Low Flow



High Flow

#1. Single Totalizing Register - All water passing through the SRH Compound Meter (both turbine and positive displacement measuring chambers) is recorded in a permanently hermetically sealed totalizing register.

- **Benefits:** Only one register is required to read, obtain totals and upgrade to various electronic capabilities; Electronic Communications Registers (ECR) are available for the TouchRead®, RadioRead® and PhonRead® data collection meter reading systems; a fixed quantity output option is also available through the Impulse Contactor (IC) register. In summary, there is a wide choice of reading options with minimal upgrade cost and reduced reading costs.

- **Alternative:** Most other brands utilize two registers which must be read separately and then totaled together; some models include two separate meters in an external bypass piping arrangement; others provide two separate odometers in a single register housing. As a result, billing and upgrading can be confusing and expensive compared to a single register arrangement.

#2. Bypass Chamber Register - To assist in performance testing and properly sizing the meter, a separate odometer with a test sweep circle is provided for the bypass chamber. This odometer is secluded under a cover to prevent accidental reading.

- **Benefits:** "Two registers with only one required to read" allows easy consumption ratio comparison as a means of checking proper meter application. (It is suggested that 10% to 20% of total consumption be measured by the bypass chamber and recorded on this odometer); Provides means for high resolution accuracy testing, reducing testing time and discharge water quantity; Bypass chamber operation can be verified.

- **Alternative:** Both readings must be added together for total consumption reading; Both chambers must be monitored during accuracy testing cycles; There are two registers to upgrade and maintain; and double exposure to vandalism problems.

#3. Magnetic Drive - The flow sensitivity of both measuring chambers is transferred to the coordinator and totalizing register by use of magnets. This eliminates the locating of any reduction gear trains in water.

- **Benefits:** Additional meter longevity; Fewer maintenance intervals; Allows a modular design for maintenance simplicity.

- **Alternative:** Direct gear driven; Water lubricated gearing drive; Debris or undue friction can affect such gearing and restrict performance.

#4. Sealed Coordinator Module - A separate, sealed compartment houses the reduction gear trains and overriding clutches for both chambers in one assembly. The coordinator is set in an oil bath for extended, maintenance free operation.

Change gears are an integral part of the design and assembly to allow final accuracy level adjustments at the factory. The change gears for accuracy calibration on both the bypass and turbine chambers are located on top of the coordinator module assembly for easy access. No service interruption to the end user is necessary during calibration.

After installation, the meter's accuracy may again be adjusted by "changing" the gear combinations for both the bypass and turbine chambers. A maximum adjustment of 5% is recommended.

- **Benefits:** The coordinator module transfers two separate chamber drives into one for ease of reading; The module is protected for extended life and is accessible without disrupting service to the customer; Field calibration is accessible for

both measuring chambers until repair or replacement becomes necessary.

- **Alternative:** Typically, a coordinator module is nonexistent on other types of compound meters; Some types offer no field calibration capability for the low flow (bypass) chamber, typically requiring replacement and service interruption; Sealed registers containing various gear combinations must be exchanged to calibrate some models.

#5. Bypass Chamber - The SRH Compound Meter's bypass chamber (also known as the piston, PD, positive displacement, or low flow chamber) is the same as used in the Sensus Sealed Register (SR®) Water Meter. This chamber is renowned for its long term accuracy, low flow sensitivity, and durability. The critical measuring element is an oscillating piston to ensure all of the water is accurately measured.

Unlike other meter brands, the SRH Compound Meter's bypass chambers are operationally sized to eliminate premature wear. Optional bronze-composition chamber housings are also available.

- 2" and 3" meter uses full 3/4" bypass chamber

- 4" size meter uses full 1" bypass chamber

- 6" size meter uses full 1-1/2" bypass chamber

- **Benefits:** Time proven measuring element; Simple design for ease of cleaning and maintenance to minimize repair costs; Full size bypass chambers will not wear out prematurely because of overspeeding; Will maintain accuracy to maximize revenues; Optional bronze chambers available to accommodate severe water conditions

- **Alternative:** Use of multijet, disc-type, or similar piston chambers; Down-sized chambers operating at high speeds can mean wear and loss of low flow sensitivity quite early. Most 2" and 3" sizes utilize a 5/8" size bypass chamber; Bronze is typically not an option for bypass chambers on other brands

#6. Turbine Chamber - High flows are measured by a horizontally mounted, axial flow turbine chamber. The SRH Compound meter is designed so that all water, regardless of flow rate, must pass through this chamber. The turbine rotor accelerates quickly, enabling it to be at full efficiency prior to a swing-action valve opening at the crossover point. Simply stated, the SRH Compound Meter features a "continuous crossover" feature for smooth operation before, during, and above the crossover flow rates.

An A.W.W.A. type strainer is recommended (but not required) directly upstream of the meter's inlet housing to protect the meter from damage caused by line debris. The chamber's inlet housing design includes integral straightening vanes to minimize any directional "swirl" of water entering the meter. The turbine chamber rotor is designed so that minimal upstream flow disturbances do not affect accuracy or long term performance.

The turbine shaft is magnetically suspended. This permits the rotating turbine assembly to operate essentially weightless in water without restriction. The turbine's shaft is supported by water lubricated hard rubber roller bearings which provide a large bearing surface for accurate service over extended time periods. This design provides a "self flushing and cleaning" capability to dislodge any debris potentially trapped within the roller cages and roller bearing surfaces.

The rotor's axial rotation movement is efficiently transferred from the horizontally mounted shaft position to a vertically mounted stainless steel upshaft via stainless steel bevel gears housed in a gearbox which separates and protects the gearing from line debris in the open water flow path. The time-proven bevel gearing design was incorporated into the Sensus Com-

pound Meter design in the early 1970s. The previous use of a worm gear connection was then eliminated due to unacceptable long term performance.

The turbine chamber housing is also available as an option in bronze material except for the 2" model.

- **Benefits:** Time proven accuracy limits of 100% (+ or - 1-1/2%) over the normal operating range, and a minimum accuracy of 95% at crossover, result in maximum sustained revenues; Smooth, trouble-free operation ensures extended maintenance intervals and minimum repair expenditures; Heavy duty stainless steel bevel gear connection design provides years of trouble-free service without remedial maintenance as seen in other worm gear designs.

- **Alternative:** In some models, strainers are mandatory because they employ a class II measuring element that is susceptible to flow disturbances; Worm or other types of drive gearing openly exposed to line debris; Meter design in certain meter types does not allow either measuring element to operate in "series", consequently accuracy loss during crossover is typical; Bronze chamber housings are not available as options; Crossover may occur at higher flow rates and overspeed the bypass chamber's measuring element and cause premature wear.

#7. Automatic Crossover Valve - A light weight swing valve controls crossover between the bypass and turbine chambers. Because of the low flow sensitivity of the turbine chamber, crossover occurs with little or no affect on efficiency.

As flow increases, the valve's weight and orientation offers reduced resistance as it swings upward to a full open position, out of the water flow path. The stainless steel valve guides contain hard rubber bushings, providing for smooth, friction-free operation. The replaceable valve seat contains a rubber insert to effect a positive seal during low flow conditions and is easily accessed.

- **Benefits:** Reduced wear factor to bypass chamber because of crossover at low flow. This means years of trouble-free and accurate low flow measurement; Reduced headloss during operation has a beneficial impact on delivery pressure and system pumping costs; The lightweight crossover valve design permits easy inspection without risk to personal safety, unlike other spring-type designs.

- **Alternative:** Use of cost-reduced, spring-action type crossover valve mechanism; Removal of such spring valves under tension may be considered hazardous and prone to causing injuries; Spring tension may vary which would impose varying performance characteristics; Valve position in two-register compound meters will affect crossover accuracy during the time it takes for the high flow chamber to pick up speed and arrive at optimum efficiency; Excessive headloss in some models; Some valve assemblies are inaccessible without first removing the entire meter from the line setting.

#8. Test Outlet and Drain Ports - A test outlet is conveniently located on top of the maincase adjacent to the downstream flange for in-line testing. An optional test riser and locking ball valve assembly is available when specified, to simplify field testing. Plugged drain ports on the base of the bronze maincase allows de-watering during maintenance

- **Benefits:** Easy access which reduces set up time during testing; Optional test riser eliminates unnecessary steps to disrupt water service to remove bronze plug and install a temporary riser; Easy to drain maincase which reduces downtime.

- **Alternative:** Test outlet located on side of meter; No test outlet provided; No easy access to remove standing water

#9. Measuring Chambers in Series - The Sensus Compound Meter design is unique because the SRH measuring chambers operate in "series" prior to crossover. All water enters the turbine chamber, diverts to the bypass chamber for measurement, then exits past a closed crossover valve. If demand increases, the crossover valve opens, and the flow is measured by the turbine chamber which is already at peak efficiency. The bypass chamber idles. Even during high flows, the bypass chamber is operating to keep it functional upon demand and to purge grit and debris. Restrictive chamber porting prevents overspeeding of the piston during peak high flow demand periods.

All other meter types offer "parallel" operation of the chambers, i.e. - each chamber is solely responsible for measuring its respective portion of flow. This is why consumption must be recorded on two separate registers and then totaled together.

The same meters also rely solely on the bypass chamber for critical measurement prior to the crossover valve opening. For example, if a typical dual-register compound meter's bypass chamber is inoperable but still allows water to flow through it, no registration can occur on either register until the valve opens and the turbine starts. The same parallel design allows significant loss of registration throughout its total operating range, resulting in considerable revenue loss.

Conversely, if the Sensus bypass chamber became inoperable, the meter would begin to register consumption at the initial flow sensitivity of the turbine chamber, which occurs well before crossover. No accuracy loss would occur at higher flow rates.

- **Benefits:** "Redundant" measuring chamber positioning provides sustained revenues throughout the flow range; Registration is maintained by the turbine if the bypass chamber becomes temporarily inoperable; Little or no accuracy loss during crossover.

- **Alternative:** Other models include measuring chambers in "parallel"; Significant revenue loss will occur at low flows and throughout the normal operating range if a bypass chamber becomes inoperable for any reason; Accuracy loss during crossover is typical due to stop-and-start requirements of the turbine measuring element.

#10. Maintenance Options - Sensus offers a variety of choices for maintaining the SRH Compound Meters now in service. These options include:

Meter Modernization and Maintenance Program (MMP) - Allows the "exchange" of an existing compound meter for a new or updated Sensus Compound Meter at a dramatically discounted price compared to an outright new meter purchase. This is a nationally advertised maintenance program offer including specified pricing for customers in the U.S. and Canada.

MMP also provides the option of purchasing a complete component "rebuild kit" which eliminates the requirement for the existing meter to be returned, providing a quick and efficient quick and efficient method of upgrade without disturbing the existing meter setting.

MMP allows customers the opportunity to upgrade Sensus Compound Meter registers for ease of reading via TouchRead, RadioRead and PhonRead systems.

Complete individual component parts and price lists are available.

- **Benefits:** A selection of programs which best satisfies the utility's needs; The utility is able to plan and budget costs effectively; Easy to standardize and upgrade meter reading capabilities, maximizing a previous meter investment.

- Alternative: Minimal or no maintenance programs offered; Some manufacturers do not offer parts, only component groups or modular assemblies; Frequent design changes and component pricing are not conducive to repairs; Some electronic register upgrades are not possible for earlier meter models because adaptation is not currently available.

Summary

Today, more than ever, utilities are being challenged to budget and invest wisely. Unfortunately, some utility managers have been enticed into promises of savings by accepting lower quality compound meters. All too quickly, time passes and those "bargain" meters begin to fail prematurely. Parts may not be available and upgrade options are too costly. After sale service may be nonexistent.

The risk of paying a lower initial purchase price is too great. This minimal "savings" vanishes quickly when evaluating the total "life cost" of owning and maintaining a compound meter system. The risk is certainly not worth the potential revenue loss for even a few days in most cases.

Many purchasing options will continue to face the water industry in the years ahead. There are a variety of compound meter designs which may, or may not, meet the needs of many utilities.

This article is intended to categorically review the Sensus Compound Meter to provide information for making an informed purchasing decision that will be beneficial to the utility. A number of important criteria will influence a utility's decision and subsequent financial position today and well into the future.

For additional information or assistance, please contact your Sensus representative or authorized distributor.

AUTHORIZED SENSUS DISTRIBUTOR



P.O. Box 487 • 450 North Gallatin Avenue
Uniontown, PA 15401
1-800-METER-IT • 1-800-638-3748

Fax: Direct to Factory
Local: 724-439-7729 • Toll Free: 1-800-888-2403
www.sensus.com (select "North America Water")
Email: h2oinfo@sensus.com