Technical Bulletin, OMNI 3000/6000 Totalizer Functions

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NOTE: User Manual Reference - This Technical Bulletin complements the information contained in the Users Manual, applicable to all OMNI Flow Computers firmware revisions.

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Scope

This Technical Bulletin applies to all firmware revisions of OMNI 3000/6000 Flow Computers.

Abstract

This Technical Bulletin discusses the Totalization Functions of the OMNI 3000/6000 Flow Computers. This bulletin does not discuss the various 'Fluid Properties' algorithms and procedures used by the flow computer to compensate measured volumes and mass quantities to base or standard conditions. Information about these algorithms and implementation procedures can be found in the standard documents published by industry standards organizations such as the American Petroleum Institute (API), and International Standards Organization (ISO). Because of international copyright laws and space limitations it is neither possible nor practical to include complete documentation on these standards within the OMNI manuals. In some cases, excerpts of these algorithms and procedures are contained in the OMNI Flow Computer Manual, Volume 3, Chapter 4 and 5, Flow Equations and Algorithms.

Basic Totalizer Function

The function of a totalizer is to continuously integrate all flow measured by the flowmeter device. Totalizers within the flow computer are tamperproof and stored in the flow computers memory as redundant long integer registers with checksum security. Long integers are used because (unlike floating point numbers) they can 'exactly' represent all whole numbers between 0 and 1,000,000,000. Sometimes the totalizers have inferred decimal resolution, i.e. the value stored in the registers represents decimal fractions of a volume or mass unit (tenths of barrels for example x.x bbls).

Increments of Flow

The flow computer monitors electrical signals from the flowmeter device and calculates incremental flow every 500 mS calculation cycle. Flowmeter signals can be pulses, where every pulse counted represents a specific volume (mass in the case of a Coriolis flowmeter) or, analog current or voltage in the case of a DP head device (orifice meter for example).

These 500 mS increments of flow are calculated to high accuracy and are stored as extended precision floating point numbers (17 decimal digits of precision). The flow increments are integrated until they are large enough to be transferred into the relevant integer totalizers. Any fractional amount (remainder) not transferred into the totalizer is saved and added to the next calculation cycle's calculated flow increment.

Multiple flow increments are calculated for each flowmeter run, every calculation cycle. These are: **Gross** volume increment, **Net** volume increment, **Mass** increment, and **Energy** increment. Liquid applications do not totalize energy but do require an **S&W corrected Net** increment.

Gross	Volumes at flowing temperature and pressure conditions
Net	Equivalent volumes at base temperature and pressure conditions
Mass	Mass quantities

For Liquid applications only:

S&W corrected Net	Equivalent volume at base temperature and pressure with **S**ediment and **W**ater removed

For Gas applications only:

Energy	Energy quantities

Order of Calculation

Flow increments for a specific flowmeter run are related to one another and are calculated in a preset order. This depends upon the flowmeter technology being used.

Flowmeters that produce volume based pulses (Turbine, PD meters, etc)

1. The Gross flow increment is calculated
2. The Net flow increment is calculated based on the Gross flow increment and fluid specific correction factors

If Liquid Application:

3. The S&W corrected Net increment is calculated by adjusting the Net flow increment for S&W content
4. The Mass flow increment is calculated based on either:
   - the Gross flow increment and fluid density at flowing temperature and pressure

     Or
   - the Net flow increment and fluid density at base temperature and pressure

If Gas Application:

5. The Energy flow increment is calculated based on either:
   - the Net flow increment and heating value per Net volume unit

     Or
   - the Mass flow increment and heating value per Mass unit

Flowmeters that produce mass based pulses (Coriolis meters)

1. The Mass flow increment is calculated
2. The Net flow increment is calculated based on the Mass flow increment and fluid density at base temperature and pressure conditions

If Liquid Application:

3. The S&W corrected Net increment is calculated by adjusting the Net flow increment for S&W content
4. The Gross flow increment is calculated based on the Mass flow increment and density at flowing temperature and pressure

If Gas Application:

5. The Energy flow increment calculated based on either:
   - the Net flow increment and heating value per Net volume unit

     Or
   - the Mass flow increment and heating value per Mass unit

DP Head Devices whose flow calculation gives a mass flow result (Orifice meters etc.)

1. The Mass flow increment is calculated
2. The Net flow increment is calculated based on the Mass flow increment, and density at base temperature and pressure conditions

If Liquid Application:

3. The S&W corrected Net increment is calculated by adjusting the Net flow increment for S&W content

Types of Totalizer

The flow computer provides the following groups of totalizers:

Cumulative Totalizers	These totalizers are never reset during normal operations. They can be reset by following a totalizer reset procedure and entering the correct security password. They are snapshot to provide opening and closing readings that appear on batch and daily reports.
Batch Totalizers	These totalizers represent a batch quantity being delivered or received. They are automatically captured for reporting purposes and reset to zero (0) when a batch end command is received.
Daily Totalizers	These totalizers represent the current daily quantity delivered or received. They are captured for reporting purposes and reset every twenty-four (24) hours at the **Day Start Hour** specified.

Flowrate Versus Totalization

The function of a totalizer is to accurately represent all flow which passed through the flowmeter device. The function of a flowrate indication is primarily operational, i.e. it is used for control purposes and should be easy to read on a digital display. Flowrates calculated by the flow computer are not integrated to provide totalizers.

Totalizers are based on the integration of many discrete flow increments that are calculated by the flow computer every 500 mS. Flowrates are also calculated using the same flow increments used to produce totalizers but they are usually digitally filtered to produce a smooth readout that is easy to read. Filtering is needed because the input data used to calculate each 500 mS flow increment may be quite variable. A frequency of 49 Hz from a turbine meter for example, would cause every other 500 mS flow increment calculation to be based on either twenty-five (25) turbine meter pulses, or twenty-four (24) turbine meter pulses, a 4% bobble which would be very difficult to read on a digital readout.

DOCUMENT REVISION HISTORY

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