Technical Bulletin, Recalculating a Previous Batch within the Flow Computer

NOTE: User Manual Reference - This Technical Bulletin complements the information contained in Volume 2, Chapter3 "Computer Batching Operations", applicable to Revision 20/24.74+ and 22/26.74+.

The '+' symbol following the firmware revision numbers indicates that all future revisions beyond the stated revision are covered by this bulletin.

Batch Recalculation – The batch recalculation feature allows you to adjust quantities of the previous four (4) batches at measurement locations where SG60/API60 and S&W values only become available after the batch has been delivered.

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Scope

Firmware Revisions 20.74+ and 24.74+ of OMNI 6000/OMNI 3000 Flow Computers have the feature of Batch Recalculation. This feature applies to Turbine/Positive Displacement/Coriolis Liquid Flow Metering Systems (with K Factor Linearization. Firmware Revisions 22.74+ and 26.74+ have a similar feature. However, the Modbus Data Points used to access data are different from those in Revisions 20/2.74+.

Abstract

The purpose of recalculating a previous batch is to make batch quantity corrections based on SG60/API60 and Sediment and Water data becoming available via sample analysis performed after a batch delivery is complete. At measurement locations where SG60/API60 and S&W values are not available online, sampler devices continuously extract a representative sample of fluid during a batch. At the end of the batch the sample container is sent for lab analysis. The data obtained from the analysis report can then be used to recalculate the batch correction factors and therefore batch quantities. Historical data from these analysis reports is also used to determine what values of SG60/API60 should be used for real time calculation of future batches that are known to have similar characteristic. These batches ultimately can also be recalculated when their actual analysis is determined.

Calculations Performed

The liquid correction factors Ctl and Cpl are first recalculated using the sample analysis SG60/API60 and the batch flow weighted average temperature and pressure calculated during the batch.

Gross Standard Volume (GSV) is recalculated using the newly calculated Ctl and Cpl.

The Sediment and Water correction factor Csw is calculated using the sample analysis S&W%.

Net Standard Volume (NSV) is recalculated using the recalculated GSV and Csw factor.

Using the Flow Computer Keypad to Recalculate a Previous Batch Ticket

CAUTION: ⚠️To ensure that previous batch data is correctly recalculated to not recalculate a batch close to ending a current batch in progress.

NOTE: Only four (4) lines can be displayed at one time. Use the scroll up or down arrows keys to display additional text.

Step 1

Press **[Prog] [Batch] [Meter] [n] [Enter]** (*n* = meter run number). The OMNI LCD screen will display:

```
METER #1 BATCH
Print & Reset ?
Select Prev# Batch
Enter API60        .0
Enter SG60      .0000
Enter %S&W        .00
Recalculating&Print?
```

Step 2

Select which previous batch you wish to recalculate. The OMNI stores the last four (4) completed batches numbered as:

> 1 = last batch completed
>
>   to
>
> 4 = oldest batch completed

Press **[↓]** to scroll down to "**Select Prev # Batch**" and enter a number between one (1) and four (4), depending upon which batch is to be recalculated.

The flow computer moves the selected previous batch data to the 'previous batch' data points within the database (see explanation later in this document)

Step 3

Enter Password when requested.

Step 4

Scroll to either "**Enter API60**" or "**Enter SG60**". Type in a valid value and press **[Enter]**

Step 5

Scroll to "**Recalculate & Print**?". Press **[Y]** and then **[Enter]**.

At this time the flow computer will recalculate the batch data and send the report to the printer and the 'Historical Batch Report Buffer' in RAM memory. Batch report data can also be captured in 'Raw Data Archive RAM' using the trigger Boolean **1n76**. The default batch report shows the batch number as **XXXXXXX** where the number ahead of the '**-**' is the batch number (**5n90**) and the number after the '**-**' is the number of times that the batch has been recalculated (**3n52**). Variable (**3n52**) is reset to '**0**' at the end of a batch and increments each time the batch is recalculated.

How the Flow Computer Manages the Modbus Database

NOTE: The second digit of the index number (indicated as "n") defines which meter run you are working with (i.e., n=1, 2, 3, or 4).

A pointer mechanism has been utilized which avoids having to have duplicate data points for every batch report variable for each of the four (4) previous batches. Only (1) one set of data points for previous batch data are mapped within the Modbus database. A pointer register is used to determine which set of previous batch data will be available by accessing the previous batch data points within the Modbus database.

Using the batch gross totalizer variable as an example, we have:

- Modbus address of Current Batch in Progress – Gross Totalizer is **5n01**
- Modbus address of Previous Batch – Gross Totalizer is **5n50**
- Modbus address of Pointer register to select which previous batch is mapped is **3n51**

As the batch progresses the gross totalizer (**5n01**) accumulates flow. At the end of the batch the flow computer performs the following actions:

- #3 previous batch data replaces #4 previous batch data
- #2 previous batch data replaces #3 previous batch data
- #1 previous batch data replaces #2 previous batch data
- Current batch data replaces #1 previous batch data
- Pointer register **3n51** is set to the value '**1**' so that the Modbus database addresses for previous batch will access data for the batch just ended. This ensures that the batch report which prints immediately at the end of a batch and gets it's data from the Modbus database, includes the correct information.

Table 1 (using the batch gross totalizer as an example) shows typical data that would be read by accessing Modbus points **5n01** and **5n50.**

The data read depends upon the value of pointer register **3n51**.

TABLE 1. Batch Gross Totalizer

STEP	DESCRIPTION	CURRENT BATCH 5n01	1ST PREV. BATCH 5n50	2ND PREV. BATCH 5n50	3RD PREV. BATCH 5nB0	4TH PREV. BATCH 5n50
	Value contained in Pointer register **3n51**		1	2	3	4
1	First batch running	12340	0	0	0	0
2	First batch ended	23450	12340	0	0	0
3	Second batch ended	34560	23450	12340	0	0
4	Third batch ended	45670	34560	23450	12340	0
5	Fourth batch ended	56780	45670	34560	23450	12340
6	Fifth batch ended with sixth batch running	6123	56780	45670	34560	23450

Previous Batch Data that Is Read/Writable

All data points shown in Table 2 for previous batch transactions are 'read/write'.

Table 2. Previous Batch Transactions

	METER #1	METER #2	METER #3	METER #4	STATION
SG 60 or Reference Density (Rev. 24.71)	8508	8608	8708	8808	8908
API 60 Gravity	8519	8619	8719	8819	8919
Sediment and Water Percentage (BS&W)	8517	8617	8717	8817	8917
Command Boolean which triggers the recalculation	2756	2757	2758	2759	1798

Batch Recalculation Modbus Registers Meter "n" Batch Recalculation

Versions 20.74+ and 24.74+ (Tables 3 and 4)

Table 3.Meter Registers

	METER #1 REGISTERS	METER #2 REGISTERS	METER #3 REGISTERS	METER #4 REGISTERS
Previous 4 Batches per meter run are held in each of the 3n51 registers	3151 (Previous 4 batches. 1=last batch, 4=oldest)	3251 (Previous 4 batches. 1=last batch, 4=oldest	3351 (Previous 4 batches. 1=last batch, 4=oldest)	3451 (Previous 4 batches. 1=last batch, 4=oldest)
SG60/Density @Ref Temp.	8508	8608	8708	8808
API60/	8519	8619	8719	8819
BS&W	8517	8617	8717	8817
Recalculate & Print (Edge-Tiggered)	2758	2757	2758	2759

Table 4. Station Registers

	STATION REGISTERS
Previous 4 Batches for Station are in 3879 (1=last batch, 4=oldest)	3879
SG60/Density @ Ref Temp.	8908
API60/	8919
BS&W	8917
Recalculate & Print (edge-Tiggered)	1798

NOTE: Station registers are available via Modbus Communications. Applies to Version 20/24.74.32

Version 20.74+

NOTE: When recalculating a previous batch and adjusting the gravity of the product using Modbus transactions, you must write both updated SG60 and equivalent API60 gravity values before sending the 'Recalculate and Print' command. API/SG conversion equations as follows:

- API60 = (141.5/SG60) -131.5
- SG60 = 141.5 / (API60 + 131.5)

Modbus Communication Summary

NOTE: Setting these registers via Variable Statement is not allowed and will not produce the expected results.

The flow computer retains data for the last four (4) completed batches. Only one (1) set of this data can be accessed at a time. Pointer registers, **3151** Meter Run #1, **3251** Meter Run #2, **3351** Meter Run #3, **3451** Meter Run #4n and **3879** for Meter Station are used to determine what set of batch data will be accessed. API60/SG60 and S&W data can be adjusted and the batch recalculated by writing a '**1**' to points, **2756** for Meter Run #1, **2757** for Meter Run #2, **2758** for Meter Run #3, **2759** for Meter Run #4 and **1798** for Meter Station.

Meter "n" Batch Recalculation

Applies to Versions 22.74+ and 26.74+ (Tables 5 and 6)

NOTE: Always write to 3n51 or 3879 to specify the number of retroactive bbls/m3 to recalculate before writing to any of the above Modbus Points.

Table 5. Meter Registers

	METER #1 REGISTERS	METER #2 REGISTERS	METER #3 REGISTERS	METER #4 REGISTERS
Previous 4 Batches per meter run are held in each of the 3n51 registers	3134 (Previous 4 batches. 1=last batch, 4=oldest)	3234 (Previous 4 batches. 1=last batch, 4=oldest	3334 (Previous 4 batches. 1=last batch, 4=oldest)	3434 (Previous 4 batches. 1=last batch, 4=oldest)
SG60/Density @Ref Temp.	8508	8608	8708	8808
API60/	8515	8615	8715	8815
BS&W	8514	8614	8714	8814
Recalculate & Print (Edge-Tiggered)	1756	1757	1758	1759

Table 6. Station Registers

	STATION REGISTERS
Previous 4 Batches for Station are in 3879 (1=last batch, 4=oldest)	3879
SG60/Density @ Ref Temp.	N/A
API60	N/A
BS&W	N/A
Recalculate & Print (edge-Tiggered)	1798

Version 22.74+

NOTE: When recalculating a previous batch and adjusting the gravity of the product using Modbus transactions, you must write both updated SG60 and equivalent API60 gravity values before sending the 'Recalculate and Print' command. API/SG conversion equations as follows:

- API60 = (141.5/SG60) -131.5
- SG60 = 141.5 / (API60 + 131.5)

Modbus Communication Summary

NOTE: Setting these registers via Variable Statements is not allowed and will not produce the expected results.

The flow computer retains data for the last four (4) completed batches. Only one (1) set of this data can be accessed at a time. Pointer registers, **3134** Meter Run #1, **3234** Meter Run #2, **3334** Meter Run #3, **3434** Meter Run #4n and **3879** for Meter Station are used to determine what set of batch data will be accessed. API60/SG60 and S&W data can be adjusted and the batch recalculated by writing a '**1**' to points, **1756** for Meter Run #1, **1757** for Meter Run #2, **1758** for Meter Run #3, **1759** for Meter Run #4 and **1798** for Meter Station.

DOCUMENT REVISION HISTORY

DOCUMENT INITIAL RELEASE DATE...23-Feb-1998

REVISION	DATE	PURPOSE / CHANGE REQUEST
A	23-Feb-1998	Maintained on the Web - Initial release
B	No Record	Maintained on the Web
C	03-June-2009	DCR 090040