Smith Meter® AccuLoad® Vapor Recovery

Bulletin AB06073 Issue/Rev. 0.2 (2/19)

Vapor Recovery System

The AccuLoad IV is able to monitor the amount of vapor leaving a loading compartment at the same time that it's measuring and controlling the amount of product entering the same loading compartment. The product entering the compartment can be delivered in volume or mass. The vapor leaving the compartment can be measured in mass only.

Overview

A typical application for this feature might include the delivery of LPG or similar light hydrocarbon product. As the product is entering the loading compartment product vapor leaves the loading compartment into a vapor recovery system or containment.

Two meters are required for the load arm to monitor/control the application:

One volumetric or mass meter will be on the liquid delivery line to monitor the product going into the loading compartment. Temperature and pressure can be configured (but not required) on the delivery line. Temperature and pressure can be used for back pressure control to maintain a particular product in a liquid state. Temperature and pressure can also be used for volume correction. Also, densitometers can be configured on the delivery line for volume correction and to convert mass to volume; reference density can also be used for mass to volume conversion. Note that either live or reference density is required. A flow control valve will be required for the delivery line.

The second meter will be located on the vapor recovery line to monitor the amount of product vapor leaving the loading compartment. The pulses from this meter always represent mass. No flow control valve will be on the recovery line. Optionally, a digital output may be configured as a “Vapor Line Valve.” This valve will open when the main product valve is open. Analog inputs representing temperature and pressure can be configured for the vapor recovery meter. Density cannot be configured for the vapor recovery meter. There is no mass to volume conversion available for the amount measured.

The AccuLoad delivery will indicate the preset amount (volume or mass) loaded into the loading compartment. It will not account for the amount metered from the vapor recovery line.

Separate vapor product totals will indicate the amount metered from the recovery line. The amount indicated will be accessible via AccuLoad Dynamic Displays and AccuLoad communications and can be included on a Configurable Report/BOL. The amount indicated will be in mass. Totals will be available for both the batch and the transaction.

There will also be a delivered net mass total which is calculated as the mass of the product delivered, less the mass of the vapor recovered. This total is accessible via AccuLoad Dynamic Displays and AccuLoad communications and can be included on a Configurable Report/BOL.

A non-resettable total is available for the vapor recovered. This non-resettable total will include the vapor recovered during a transaction and when a transaction is not in progress. The total can be cleared in via the program mode diagnostics “Reset Totals.” The total can be viewed on the display when the “Non-Resettable Volumes” are chosen from the run mode diagnostics.

Diagnostics will show the pulse counts received from both the liquid loading meter and the recovery line meter.

Mass and volume totals can be programmed to account for reverse flow similar to what a straight load arm type normally does. Dual pulse is required for forward and reverse flow detection. If the dual pulse signal on the liquid line is such that the “A” pulse leads the "B" pulse, then it’s assumed that the liquid product is entering the delivery compartment and the transac-

tion totals will increment. If the dual pulse on the liquid line is such that the “B” pulse is leading the “A” pulse, it’s assumed that the liquid product is leaving the loading compartment and entering the storage compartment and the transaction totals will decrement. On the vapor recovery line, if the "A" pulse leads the “B” pulse, it’s assumed that vapor is leaving the loading compartment and entering the storage compartment. If the “B” pulse is leading the “A” pulse, it’s assumed that the vapor is leaving the storage compartment and entering the loading compartment.

If dual pulse is not used in the application, it will be assumed that all vapor recovered is leaving the loading compartment and entering the storage compartment. All measured mass from the liquid meter is entering the loading compartment.

Bays can be configured with load arms configured for using the vapor recovery feature. Totals for the vapor recovered mass and delivered net mass will be the summation for all the load arms configured on the bay.

A maximum of three load arms can be configured on the AccuLoad with the arm type configured for using the vapor recovery feature as this arm type requires two meters and the AccuLoad has a maximum of six meter inputs.

Programming the Vapor Recovery Feature

To implement this feature the following program mode parameters are used.

Configuration Directories – System Layout

Program Code #002, 004, 006, 008, 010, 012

To implement this feature the load arm type selected is “Straight with VRS,” which stands for Straight Load Arm with vapor recovery system. Shown below are the existing selections for this program code along with this new selection.

- Straight
- Sequential
- Ratio
- Side Stream
- Unloading
- Hybrid
- Straight with VRS

The following are the new criticals that were added to support the load type arm “Straight with VRS.”

Program Code #003, 005, 007, 009, 011, 013

These program codes identify how many products are associated with the respective load arm type. The following critical was added for these program codes:

Critical: “Straight with VRS” requires this parameter to be programmed at 2.

Configuration Directories – DC & AC Digital Outputs

Program Code for Output #1 through #78

To use the option for an on/off valve in the vapor product line, a new function selection is available for the Digital Outputs. The selection will be Vapor Line Valve. If configured, the AccuLoad will open the vapor line valve when the main product valve is open.

The following critical was added for these program codes:

Critical: Upstream and downstream solenoid not available for vapor recovery line.

Critical: Pump not available for vapor recovery line.

Configuration Directories – Analog Inputs/Outputs

Program Code for Inputs #1 through #6

Analog inputs for temperature and pressure can be configured for the vapor recovery line. A density input cannot be configured on the vapor recovery line. Analog input functions (temperature, pressure and density) are available for the liquid line.

The following critical was added for these program codes:

Critical: Density cannot be configured for the vapor recovery meter.

Program Code for Outputs #1 through #6

Since the vapor recovery line cannot be configured with a control valve, the following critical was added for these program codes:

Critical: Analog Valve not available for vapor recovery line.

Installation Wiring of the Meter Pulse Inputs for the Vapor Recovery Feature

This load arm type requires two meter inputs. The first meter is the liquid meter, while the second meter on this load arm is always the vapor recovery meter. Successive numbered meter inputs must be used when connecting the meter pulses to the AccuLoad.

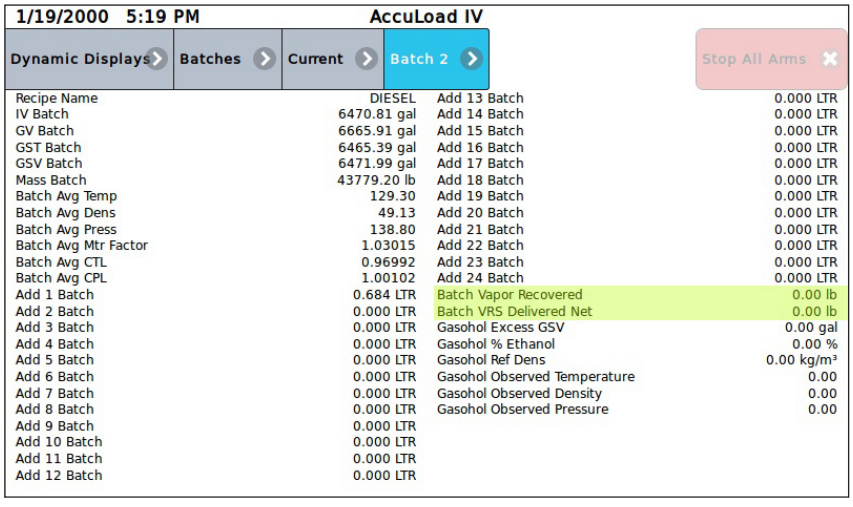
Example 1: Assume that load arm 1 is configured as a “Straight with VRS” load arm. When looking at the installation manual the pulse input(s) for “Meter #1” indicate where the liquid meter pulse connections are made. The pulse input(s) for “Meter #2” indicate where the vapor meter connections are made.

Example 2: Assume load arm 1 is configured as a single product “Straight” load arm, while load arm 2 is configured as “Straight with VRS.” The meter pulses for load arm 1 are connected to the pulse input(s) identified as “Meter #1” in the installation manual. The liquid line meter for the “Straight with VRS” arm would be connected to the pulse input(s) labeled as “Meter #2.” The vapor meter would be connected to the pulse input(s) identified as “Meter #3” in the installation diagram.

Dynamic Displays

The totals measured by the delivery line (Meter #1) will be indicated in the batch and transaction Dynamic Displays.

The Dynamic Displays will be updated to indicate the batch and transaction mass measured from the vapor recovery line meter. It will also indicate the delivered net mass; the net mass is the mass measured from the delivery line meter (Meter #1) less the mass measured by the vapor recovery meter (Meter #2). To view the mass measured by the vapor recovery meter and the net mass, enter the Dynamic Display for the load arm configured for “Straight with VRS” and select the batch Dynamic Display. The mass measured will be as indicated:



If the load arm is not configured as “Straight with VRS” then the batch and transaction Dynamic Displays will not indicate an amount for “Vapor Recovered” or “Delivered Net.”

Communications

Four new communication commands were added to support this new feature. Commands VB and VX will indicate the vapor recovered mass for a batch and transaction. Commands PN and PX will indicate the net mass for a batch and transaction. The net mass is the mass measured from the delivery meter (Meter #1) less the mass measured by the vapor recovery meter (Meter #2). For complete details refer to communications manual MN06204L.

VB Command: This command is used to retrieve the vapor recovered mass of the current batch and a historical batch in a completed transaction in local storage.

VX Command: This command is used to retrieve the vapor recovered mass of the current transaction and a historical completed transaction in local storage.

PN Command: This command is used to retrieve the vapor recovered net mass of the current batch and a completed batch.

PX Command: This command is used to retrieve the vapor recovered net mass of the current transaction and a completed transaction.

The VT command was updated so the non-resettable total for the vapor recovered mass can be retrieved via communications.

The following are the new Modbus communication addresses for the vapor recovery system feature; refer to Modbus Communications Manual MN06131L for complete detail:

Modbus Address	Ending Address	Data Set	Data Point	Data Type
4600	4603	Trans Run Data	Straight arm with VRS Recovered Mass	IEEE double precision float
4604	4607	Trans Run Data	Straight arm with VRS Net Mass	IEEE double precision float

Modbus Address	Ending Address	Data Set	Data Point	Data Type
7544	7547	Trans Run Data Batch 1	Straight arm with VRS Recovered Mass	IEEE double precision float
7548	7551	Trans Run Data Batch 1	Straight arm with VRS Net Mass	IEEE double precision float
9080	9083	Trans Run Data Batch 2	Straight arm with VRS Recovered Mass	IEEE double precision float
9084	9087	Trans Run Data Batch 2	Straight arm with VRS Net Mass	IEEE double precision float
10616	10619	Trans Run Data Batch 3	Straight arm with VRS Recovered Mass	IEEE double precision float
10620	10623	Trans Run Data Batch 3	Straight arm with VRS Net Mass	IEEE double precision float
12152	12155	Trans Run Data Batch 4	Straight arm with VRS Recovered Mass	IEEE double precision float
12156	12159	Trans Run Data Batch 4	Straight arm with VRS Net Mass	IEEE double precision float
13688	13691	Trans Run Data Batch 5	Straight arm with VRS Recovered Mass	IEEE double precision float
13692	13695	Trans Run Data Batch 5	Straight arm with VRS Net Mass	IEEE double precision float
15224	15227	Trans Run Data Batch 6	Straight arm with VRS Recovered Mass	IEEE double precision float

15228	15231	Trans Run Data Batch 6	Straight arm with VRS Net Mass	IEEE double precision float
16760	16763	Trans Run Data Batch 7	Straight arm with VRS Recovered Mass	IEEE double precision float
16764	16767	Trans Run Data Batch 7	Straight arm with VRS Net Mass	IEEE double precision float
18296	18299	Trans Run Data Batch 8	Straight arm with VRS Recovered Mass	IEEE double precision float
18300	18303	Trans Run Data Batch 8	Straight arm with VRS Net Mass	IEEE double precision float
19832	19835	Trans Run Data Batch 9	Straight arm with VRS Recovered Mass	IEEE double precision float
19836	19839	Trans Run Data Batch 9	Straight arm with VRS Net Mass	IEEE double precision float

21368	21371	Trans Run Data Batch 10	Straight arm with VRS Recovered Mass	IEEE double precision float
21372	21375	Trans Run Data Batch 10	Straight arm with VRS Net Mass	IEEE double precision float

4600	4603	Bay Run Data	Straight arm with VRS Recovered Mass	IEEE double precision float
31212	31215	Bay Run Data	Straight arm with VRS Net Mass	IEEE double precision float

6056	6059	Vapor Recovered Mass Run Data	Vapor Recovered Mass Non-Resettable Total	IEEE double precision float

Miscellaneous

Auto Proving

The AccuLoad Auto Proving feature is available for the delivery line meter (Meter #1). This feature is not available to work with the vapor return meter (Meter #2).

Pulse Output

The pulse output will allow output impulses representative of the amount of product measured by the liquid meter and vapor return meter.

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 AB06073 Issue/Rev. 0.2 (2/19)

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