Overview

Note: *This feature is only available when using AccuLoad III-X Revision 10.01 firmware or better.*

This mode of delivery allows for unloading a truck compartment without entering a preset volume. Implementing this feature requires the load arm type to be programmed as "unloading." Up to six load arms can be configured as "unloading" in an AccuLoad III-Q unit and up to two in the AccuLoad III-S hardware. The unloading arms can be configured with loading arms in the same unit.

Control of delivery is accomplished by the use of three digital inputs, configured as stop, low, and high flow switches. These inputs define when to open the valve, when to advance from the low flow rate to the high flow rate, and when to close the valve.

General purpose inputs can be set up using Boolean equations (UNLOAD3.EQX) to operate as product line security flow switches, with one switch per product. The purpose for monitoring these switches is to ensure that the correct product line is in use for the product currently being unloaded.

AccuLoad III unloading also supports a feature which aids in the detection of a contaminant during unloading. This is designed to detect a contaminant that has a higher density than that of the product being unloaded. During the course of the unloading operation, a maximum of 10 discrete density samples over a programmable delta volume can be recorded. The percentage of the total unloaded volume which is composed of the contaminant will be calculated using the last complete sample as the product density.

Gear pump operation and options for shutting off the main pump for the unloading operation may be implemented through the use of Boolean equations. It should be noted that if a digital output is configured for a pump configured to an unloading arm, pump operation will operate as it does for other load arm configurations (i.e., straight, sequential blender, ratio blender). If there are special requirements for the pump on a loading arm, the output should be configured as a general purpose output (not a pump) and equations should be designed to control this output.

The Boolean Equations are included in AccuMate: UNLOAD1.EQX, UNLOAD2.EQX and UNLOAD3.EQX.

Unloading Arm Configuration

An unloading arm can support up to six products. Additive injection is not supported with unloading. Since there is no blending associated with unloading, all recipes associated with an unloading arm must be 100% of a specific product. Recipe Parameter 004 – First Delivered defines which product will be unloaded. For example, if Product 2 is the entry for this parameter, then volume totalization will count towards Product 2.

Operator Interface

Presetting a batch with an unloading arm is similar to that of a straight product delivery arm except that a preset amount is not entered. To begin an unloading operation, press the SET key. This will initiate the pixel display test and the presentation of the transaction ID and/or any user-programmed prompts. Select a recipe at the "recipe" prompt. This recipe determines which product is being unloaded so the associated product switch can be monitored and the AccuLoad can determine the product towards which to accumulate volume. There is no injector activation since additive injection is not permitted with unloading. If an additive injector mask is made through communications, the AccuLoad will issue a "NO03" (communications value rejected) response.

Press the START key to begin unloading and to display the unloading counter that indicates the progress of the unloading process. The "amount remaining" display is not shown on the delivery screen. The maximum amount that can be unloaded is 999,999; at this point the valve will close and the batch will be complete.

Control of Delivery

Once the "Start" key is pressed, the pump will be turned on and the AccuLoad will monitor the DE Head Stop Flow Switch for the period of time programmed in the zero flow timer program code. If the switch remains uncovered for the time period entered, the pump will be turned off. To continue delivery, press the START key again. An entry of 0 for the zero flow timer will disable this feature.

Once the stop switch is covered, the valve will be opened and low flow delivery will be initiated. The low and high flow switches will now be monitored. When the high flow switch is covered, the valve is opened to increase the flow rate to the high flow rate. High flow delivery remains in effect until both the high and low flow switches are uncovered, at which time low flow delivery occurs again. This sequence continues until the stop switch is uncovered or any invalid switch combinations occur (e.g., stop switch covered, low flow switch uncovered, high flow switch covered). At this point, the pump is turned off and the valve is closed. Invalid switch combinations result in a "DE Head Alarm." To continue delivery, clear the alarm pursuant to current programming. Press the START key to continue, or press the PRINT key to terminate the unloading operation.

Configuring flow switches requires programming the digital inputs for three new functions: DE Head High Flow, DE Head Low Flow, and DE Head Stop Flow. The following is an example of an AccuLoad display indicating these functions for digital input #7:

```
 325 7 AC              DE Head High Flow
->  DE Head High Flow
    DE Head Low Flow
    DE Head Stop Flow

                 More…
```

If a digital input is assigned as one of these functions, a load arm must be assigned to the digital input. These functions are not available on the AccuLoad III if no load arm is configured for unloading.

The status of these flow switches is available by viewing the digital input diagnostics in AccuLoad III Run Mode. The chart at the bottom of the page summarizes the switch positions and corresponding delivery mode.

Using the Zero Flow Timer Command

The zero flow timer is Parameter 209 in the Load Arm / Flow Control Directory. This two-digit entry allows the operator to select the amount of time (in seconds) that the stop float can remain uncovered after the start key is pressed. In addition, this time value is the length of time the AccuLoad ignores zero flow. An entry of 0 seconds disables this feature, resulting in infinite time out. If the stop switch remains uncovered for the specified amount of time, or if a zero flow timeout occurs, the AccuLoad III will go into Stop Mode just as if the STOP key had been pressed. The operator must take the necessary corrective action to restart the AccuLoad III and then wait for the start after stop delay (if programmed) to expire before pressing the START key to resume operations.

Delivery Modes								
Switch	High Flow	Shutdown[1]	Shutdown[1]	Shutdown[1]	Low Flow[2]	Shutdown[1]	Low Flow[2]	Normal Shutdown
Stop	On	Off	On	Off	On	Off	On	Off
Low	On	On	Off	Off	On	On	Off	Off
High	On	On	On	On	Off	Off	Off	Off

On = Covered / closed; AC present
1 = Results in generation of a "DE Head Alarm"
2 = Includes high delivery mode as well if all switches were on first.

The following are the conditions under which the zero flow timer will be used:

- Entries required
  - Any entry other than zero in the zero flow timer program code
- Operations required
  - Immediately after pressing START and clearing any permissive delays
  - Before operator-requested stop
  - Before normal batch termination
  - (Optional) Configuration of a stop switch if stop switch monitoring is to be used
- Conditions under which zero flow timer will not be used
  - After operator requests stop or alarm condition
  - After normal batch termination
  - After improper program code entries
  - After a zero flow condition results in a pulse transmission situation (for example, valve open and zero flow)

Optional Boolean Equations for Pump Operation

The following identifies the operation of two standard sets of Boolean algebraic equations. The operator must program a digital output as "General Purpose" for each identified pump.

Low Float Method (UNLOAD1.EQX)

If the low float method is selected, a timer will be started when the low float switch is uncovered. If the low float switch is not re-covered before the timer expires, the main pump will be shut off. Note that the low float will not be monitored for starting the pump shutoff delay until the low float has been covered after flow starts; therefore, if the low float is never covered, the pump will not be shut off until the stop float is uncovered. The gear pump delay will start when the stop float has been uncovered. When the gear pump delay expires, the gear pump is shut off.

Flow Rate Reduction Method (UNLOAD2.EQX)

If the flow rate reduction method is selected and the flow rate is reduced to the specified pump flow rate setting, a delay will be started. If the flow rate remains at or below this specified flow rate for the duration of the timer, the main pump will be shut off. The gear pump delay will not start until the stop float has been uncovered. When the gear pump delay expires, the gear pump is shut off.

Density Samples and Contamination Percentage

Up to ten density samples may be taken over the course of a batch. Taking density samples requires either an analog input or pulse input on the AccuLoad III to be configured as a density input. These are volume-weighted average densities over the programmed delta volume. The samples are available in product dynamic displays (only displayed for current batch) and current transaction report printing; they are not archived in flash memory storage. The ten samples available are for the last batch only and should not be configured for printing unless only one batch per transaction is programmed in the AccuLoad. The density sample for the last complete delta volume is used as the density of the pure product when calculating the percentage of the contaminant present. This density, identified as "Last Density Sample," is available for report printing and is also achieved in flash memory.

Set-Up Guide

Step 1: Designate the load arm for unloading

In the Configuration directory, set the load arm type to "Unloading". For Load Arm 1, this is Parameter 002.

Step 2: Select the number of products for the unloading arm

Up to six products are allowed for an unloading arm. The AccuLoad will provide separate totals for each of these products.

Step 3: Configure inputs for the DE Head

Set up digital inputs for the three DE Head float switches: Stop, low flow, and high flow.

Step 4: Set up the flow profile

Set up the low and high flow rates. Note that unloading uses neither the minimum flow rate nor the trip points.

Step 5: Set the Valve Close Delay

Load Arm Parameter 228, Valve Close Delay, defines the amount of time the valve should remain open after the stop float is uncovered. This entry is in seconds, and may be set to zero if no such delay is desired.

Step 6: Define at least one recipe

At least one recipe must be defined for this unloading arm. No percentages are entered since there is no blending. The recipe identifies the product to be unloaded so that separate totals can be maintained for each of the products.

Step 7: Contaminant Detection (optional)

If contaminant detection is desired, there are two parameters that govern this feature. Product Parameter 415, Delta Volume, defines the product volume between density samples. For example, an entry of 100 would specify that density samples were to be taken every 100 gallons. Product Parameter 416, Contaminant Density, allows the density of the contaminant to be entered.

The percentage of contaminant is calculated at the end of each batch. This value is available for printing and is archived with the transaction. It also appears in the batch dynamic displays.

Contaminant Density allows the operator to enter the density of contaminant. Units are dependent on the entry made in the Density Units program code. Note that the percentage of contaminant delivered cannot be calculated unless the density of the contaminant exceeds the density of the product delivered. This parameter is located in the Load Arm / Meter / Product directory and is identified as 416 Contaminant Density. The range of this entry is 0 to 9999.99.

The following new communications commands have been added to support Unloading.

Command Code CP – Request Contaminant Percentage

This command requests the percentage of contaminant from the AccuLoad III.

Command

Current Transaction

CP	Current percentage of contaminant for the current batch
CP_YY	Percentage of contaminant for a specified batch

Local Storage

CP_YY_NNN	Returns the requested percentage of contaminant for a previously completed batch

Where YY = Batch Number (01 – 10)
NNN = Number of transactions back into Local Storage to retrieve data

Response

Current Transaction

CP_YY_XXX.X	Good Response

Local Storage

CP_YY_XXX.X_NNN	Good Response

Where YY = Batch Number (01 – 10)
XXX.X = Percentage of contaminant
NNN = Number of transactions back into Local Storage to retrieve data

or…

NOXX	The percentage of contaminant was not read

Where XX = 03 Value rejected
= 05 No transaction ever done
=19 Option not installed

Remarks: None

Constraints: Density units are as programmed into AccuLoad III

Special Case: None

Comm Modes: Polling only, Poll & Authorize, Remote Control, Poll & Program

Command Code DS – Display Density Sample

This command retrieves one of ten density samples from the AccuLoad III for the current batch.

Command

Current Transaction

DS_X For the current batch, returns the density sample requested

Where X = Specific Density Sample (0 – 9)

Response

DS_X_VVVV.V For DS_X

Where X = Specific Density Sample (0 – 9)
VVVV.V = Density of the specific density sample

or…

NOXX

Where XX = 03 Value rejected
= 05 No transaction ever done

Remarks: None

Constraints: Density units are as programmed into AccuLoad III

Special Case: None

Comm Modes: Polling only, Poll & Authorize, Remote Control, Poll & Program

Command Code LS – Request Last Density Sample

This command requests the last density sample taken during an unloading batch.

Command

Current Transaction

LS	Last density sample from the current batch
LS_YY	Last density sample for a specified batch

Local Storage

LS_YY_NNN	Returns the density sample for a previously completed batch

Where YY = Batch Number (01 – 10)
NNN = Number of transactions back into Local Storage to retrieve data

Response

Current Transaction

LS_YY_XXXX.X	Good Response

Local Storage

LS_YY_XXXX.X_NNN	Good Response

Where YY = Batch number (01 – 10)
XXXX.X = Last density sample
NNN = Number of transactions back into Local Storage to retrieve data

or…

NOXX	The percentage of contaminant was not read

Where XX = 03 Value rejected
= 05 No transaction ever done
=19 Option not installed

Remarks: None

Constraints: Density units are as programmed into AccuLoad III

Special Case: None

Comm Modes: Polling only, Poll & Authorize, Remote Control, Poll & Program

Revisions included in AB06055 rev 0.1 (10/10):

Stop Float Method removed from page 3.

The Boolean Equations are included in AccuMate: UNLOAD1.EQX, UNLOAD2.EQX AND UNLOAD3.EQX

USA Operation
1602 Wagner Avenue
Erie, Pennsylvania 16510 USA
P:+1 814.898.5000

Germany Operation
Smith Meter GmbH
Regentstrasse 1
25474 Ellerbek, Germany
P:+49 4101 304.0

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www.GuidantMeasurement.com