Overview

The AccuLoad III.net firmware starting in revision 11.04 was enhanced to provide a continuous in-line blending option or commonly referred to as a Wild Stream Blender. This feature is intended to be used in applications where it is desired to continuously blend 2 or more products where a preset volume is not normally used. The AccuLoad III's Hybrid Arm Configuration is used for the Wild Stream Blender application. With the Arm Configuration programmed as Hybrid, the system plumbing can be Side Stream, Ratio or Hybrid style configurations. Therefore there is an Unlimited Preset parameter available for the hybrid arm configuration that is used to enable this feature. In the Hybrid Arm configuration, the first meter(s) configured/programmed is the controlled meter stream(s) followed by configuring/programming of the wild-stream or main product stream meter (sometimes referred to as the Sequential meter in a normal Hybrid Arm configuration). The AccuLoad allows for this stream to be uncontrolled (controlled by external means) via the Valve Type parameter set to "Wild Stream". The other meter stream(s) will be controlled (blend stream). The controlled meter(s) may be plumbed and configured upstream (side-stream) or downstream (ratio) of the wild stream meter. Refer to Figure 1 (Upstream plumbed).

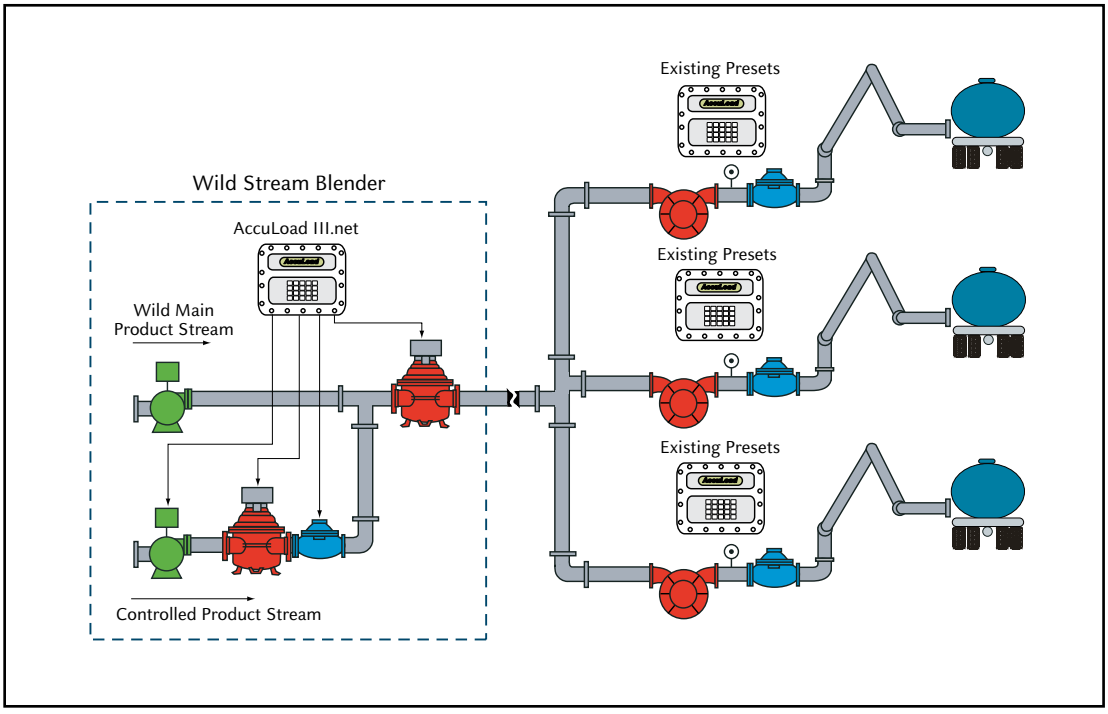


Figure 1

There are other configuration methods available for the Wild Stream Blender. Refer to the section on: “On the Fly Blend % and Meter Changes”. This configuration sometimes referred to as Cascading meters, allows for multiple controlled stream meters. This is to allow different size meters to be used for the controlled products based upon the required flow rate for different recipe percentages. Refer to Figure 2.

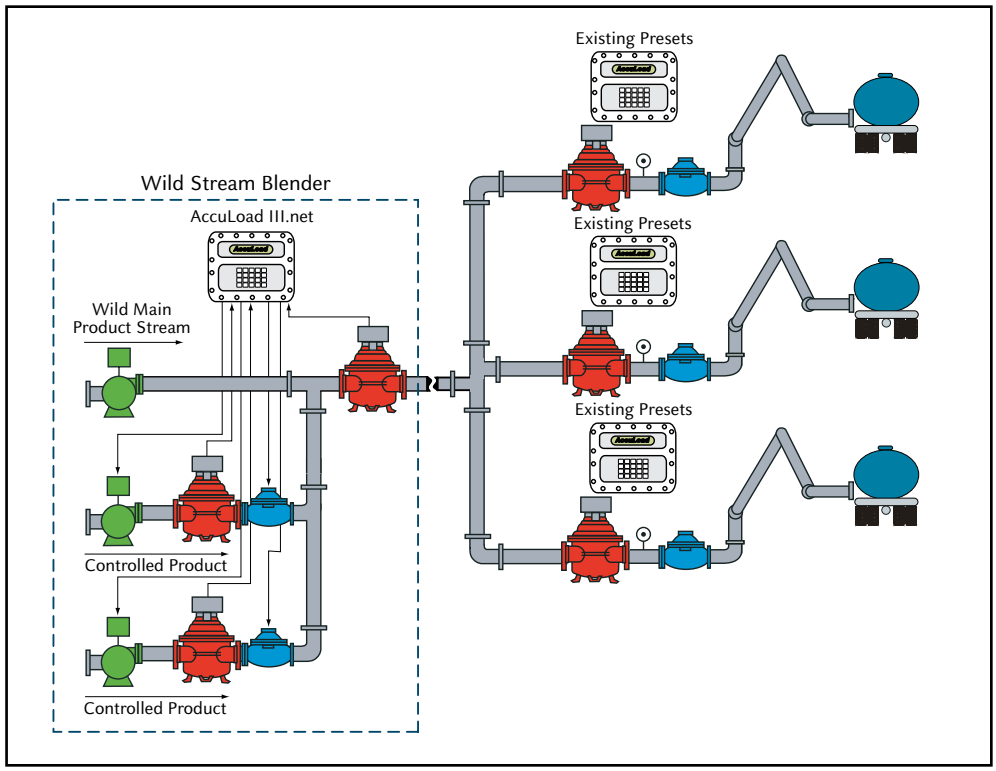


Figure 2

The AccuLoad III-Q has the capability to program up to three Hybrid arms for Wild Stream Blending with two products each. This can be used in an application where an existing load rack with existing presets that is currently doing straight product delivery such as diesel fuel and is going to be retrofitted for adding biodiesel (B100) to be able to deliver blended diesel such as B2, B5... This assumes the existing presets cannot be used (upgraded) or are not intended to do the blending function. This is applicable to ethanol blending as well. Figure 3 illustrates this scenario.

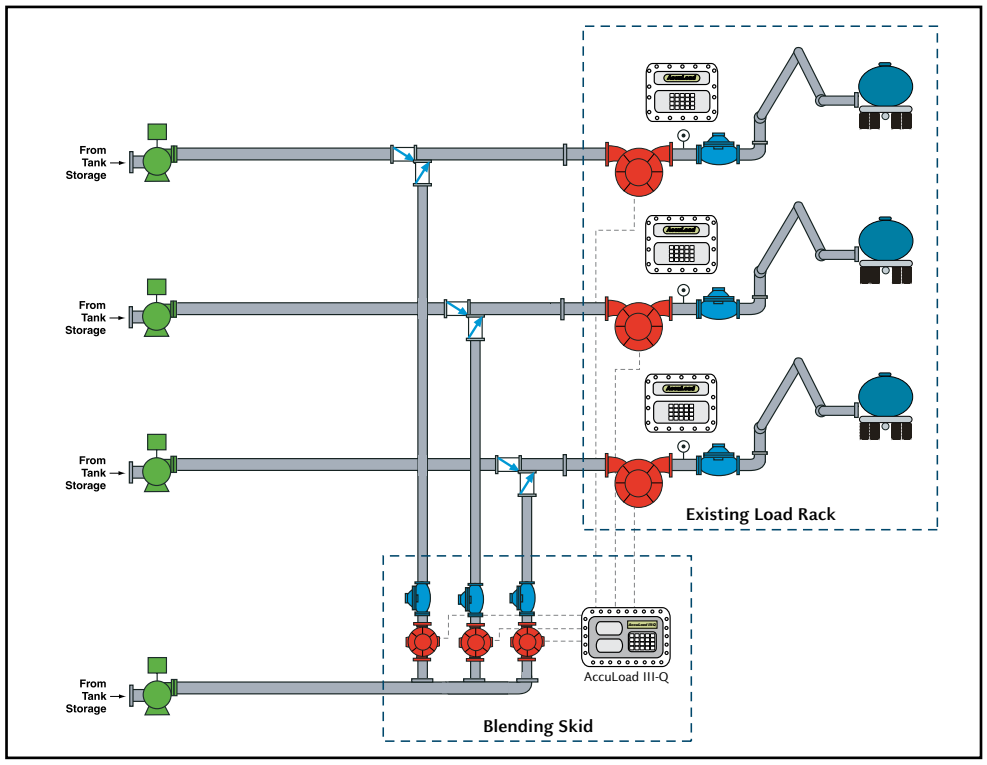


Figure 3

Flow Control and Blend Correction

When configured for Unlimited Preset with a wild-stream meter, the desired flow rates will not be based on a programmed high flow rate or low flow start rate. Instead the desired flow rate for the controlled products will be based on the actual flow rate of the wild stream. The AccuLoad will attempt to adjust the flow rates for the controlled products to produce the programmed blend ratio.

If all products are controlled (no wild-stream meter), the desired flow rates will be based on the programmed High Flow Rate (Arm 205) or Low Flow Rate (Arm 201). In this configuration, the Arm High Flow Rate will not be exceeded.

When the Unlimited Preset mode of operation is used, the AccuLoad has a different blend control algorithm that is used versus what is used for a traditional batch volume preset operation. This algorithm will correct for any blend errors within a programmable amount of time.

At programmable time intervals (using Arm 225 – Ratio Factor Time), the expected volume for the controlled product will be calculated based on the actual wild stream volume delivered. If the expected volume and the actual volume differ by more than a programmed blend correction volume (Arm 306 – Blend Correction Volume), a new desired flow rate for the controlled product(s) will be calculated to correct the blend ratio. The AccuLoad will attempt to correct the blend ratio within a programmable amount of time (Arm 307 – Blend Correction Time).

The blend tolerance parameters in the AccuLoad III are used as follows:

Arm 306 Blend Correction Volume – when blend error exceeds the "Blend Correction Volume", the AccuLoad III will start making blend corrections.

Arm 302 Blend Tolerance Amount – when blend error exceeds the "Blend Tolerance Amount" for programmable amount of time (Arm 304 – Blend Tolerance Timeout), the AccuLoad III will set a Blend High or Blend Low Alarm.

When a blend correction is made and a new desired flow rate has been calculated, the tighter flow adjust tolerance (Arm – Meter Directory 208) will be used for the time programmed into the flow adjust timer parameter (Arm – Meter Directory 209).

If the desired flow for the controlled stream is calculated to be less than the meter's programmed Minimum Flow Rate (Arm – Product Directory 201), the desired flow will be set to the meter's Minimum Flow Rate. If the desired flow rate for the controlled stream is calculated to be greater than the meter's programmed Maximum Flow Rate (Arm – Product Directory 202), the desired flow rate will be limited to the Maximum Flow Rate value.

If the flow rate of the wild stream or main stream falls below its programmed Minimum Flow Rate, the valves for the controlled products will be commanded to close. A block valve on the wild stream can be installed and programmed so that this line can be stopped by an alarm if desired.

Note: *it is required to program Minimum and Maximum Flow Rates for the wild stream meter even though the stream is uncontrolled.*

The Arm High Flow Rate parameter (Arm 205) and Low Flow Start (Arm 201) will not be used if wild-stream blending and Unlimited Preset is enabled. If desired, the wild stream meter flow rate may be monitored for excess high flow by using the product's High Flow Rate (Arm – Product Directory 202) and Excess High Flow Rate (Arm – Product Directory 209) parameters.

The Arm High Flow Rate (Arm Directory 205) is used to set the desired flow rate for the arm if all meters are controlled (no wild stream meter). The Arm High Flow Rate can also used when proving any of the meters including the wild-stream meter. The Low Flow Start Rate (Arm Directory 201) can also used if all meters are controlled (no wild stream meter). Blend adjustments will be made once the Low Flow Start amount has been delivered.

Delivery Mode

The AccuLoad will power up in the Ready Mode. After pressing the SET key the display will indicate "Press START when ready". If there are multiple recipes programmed to setup different required blend ratios, after the Recipe is selected the screen will then indicate "Press START when ready". The user may start a batch by pressing the START key, or through a communications command or using a Remote Start digital input.

Parameter (System 140 – Stop Key Disable) allows for the STOP key to be disabled for arms with a wild stream meter. This parameter applies to those arms configured with a wild stream meter only. If the STOP key is not disabled, the user may press the STOP key at anytime to stop the flow on the controlled product regardless of whether there is flow on the wild stream. The batch must be re-started before blending will be resumed.

Even though this application is intended for continuous in-line blending with an unlimited preset, the AccuLoad will still function in a batch delivery mode. The maximum batch size internally to the AccuLaod is 9,999,999 units of volume. The GV, GST and GSV volumes are calculated using batch load average meter factor, temperature and density. So therefore it is suggested that the batches be ended at least every 24 hours, so that data can be archived and batch totals and load averages can be reset for optimum blending results.

To provide for a method to automatically start a new transaction (at every 24 hours for example) regardless of whether there is flow, two parameters (Arm 112 and 113 – Transaction Reset Time and Start Hour) allow for specifying a time interval in hours to automatically end the current transaction and restart a new transaction. If the reset time is a factor of 24, then the transactions will reset the same time everyday.

Any of the traditional means may be used to end the transaction (Print key, ET command, digital input, and Auto Reset Timer). However, flow must be stopped before ending the transaction using these methods.

Permissive inputs, Remote Stop and Start digital inputs may also be configured and will function as normal regardless of whether there is flow on the wild stream (ex. loss of permissive will cause controlled product's valve to be commanded to close). Additive injectors may also be configured. The Additive Stop option may not be used with the Unlimited Preset feature.

The blend ratio can be continuously monitored. An alarm (BH: Blend High or BL: Blend Low) can be set if the blend ratio falls outside of the blend tolerance range programmed into the Blend Tolerance Amount (Arm 302) parameter for longer than a programmable amount of time (Arm 304 – Blend Alarm Timeout). The Blend Tolerance Percentage (Arm 301) parameter will not be available in the Unlimited Preset mode. Since batch volumes can be very large, a blend % would allow more error as the delivered volume increases. The blend alarm will not be checked until the blend alarm min volume (Arm 305) has been delivered.

If power is lost during a batch, when power is restored the AccuLoad III will be power up with all valves closed. The user must re-start the batch before blending will resume.

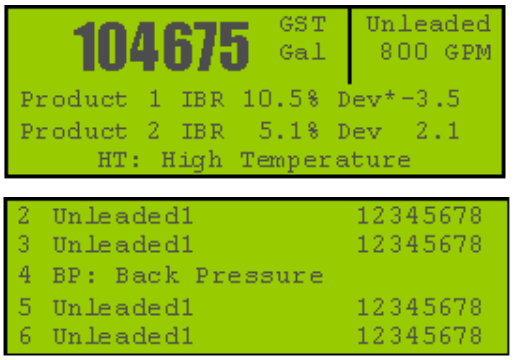
The Zero Flow Timer can be used to monitor for no flow conditions during a transaction on any of the products including the wild stream. The Valve Fault Timer and alarm can be used to indicate flow on any of the products including the wild stream when no batch is in progress.

If the AccuLoad is configured for Unlimited Preset with a wild-stream meter, a block valve may be configured to the wild-stream product if desired. The block valve will be opened at the start of the batch allowing the wild-stream to flow. If the batch is stopped at the AccuLoad using any of the available methods (ex. STOP key, communications command, or an alarm occurs), the block valve would be closed. This would provide a means for the AccuLoad to start and stop the flow of the wild-stream.

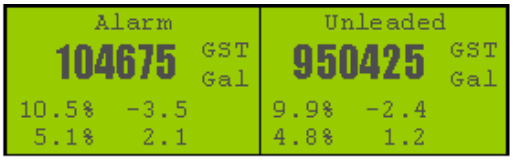
Delivery Screen and Dynamic Displays

The delivery screen and status screen will appear as shown below.

Full Screen View



Split Screen View



Where:

Product n = programmable product ID for product.

Unleaded = programmable recipe ID.

104675 = total delivered volume in delivery volume type.

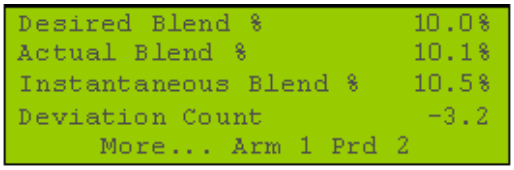
IBR = instantaneous blend ratio for controlled product using current flow rates for the blend stream and wild stream.

Dev = deviation count (difference in expected volume and actual volume of blend product). An asterisk in front of the deviation count indicates that blend correction is currently in progress.

800 GPM = total flow rate of wild stream and controlled stream.

Note that the volumes shown are in the programmed delivery units (System Directory 333) and blend % is calculated using programmed preset units (System Directory 332).

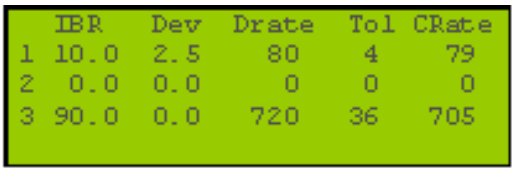
The deviation count and instantaneous blend ratio are displayed in the Load Arm Product Dynamic Displays as shown below. These items will only appear if the arm is programmed for unlimited presetting and for the products that are controlled (not displayed for the wild stream product).



The deviation count will be the error in expected volume and actual volume for the specified product. An asterisk in from of the deviation count indicates that blend correction is currently in progress.

The instantaneous blend % is the blend % for the last 2 minutes of delivered volume.

The instantaneous blend % and deviation count will also be displayed in the Ratio Blend Data Dynamic Display as shown below.



The instantaneous blend % and deviation count will also be available via communications using the DY command as shown below:

Command	Response
DY Px30	DY Instantaneous Blend % XXX.XX
DY Px31	DY Deviation Count SXXXX.XX

Recipe Select Digital Inputs

There are optional digital input functions that allow for the remote selection of recipes and starting of transactions. Up to 3 digital inputs may be used to select from recipe 1 thru 7 (i.e. the digital inputs are binary encoded).

Input #3	**Input #2**	**Input #1**	
Off	Off	Off	Transaction End
Off	Off	On	Recipe #1
Off	On	Off	Recipe #2
Off	On	On	Recipe #3
On	Off	Off	Recipe #4
On	Off	On	Recipe #5
On	On	Off	Recipe #6
On	On	On	Recipe #7

If the recipe selected via the digital inputs changes to a new recipe “on the fly” (i.e. after a batch has been started), the batch will not be ended but the blend % of the new recipe will be used from that point on.

If a new recipe is selected and the transaction is already in progress but the current batch is done, the transaction will be ended and a new transaction will be started using the selected recipe.

A value of 0 on the recipe select inputs will cause the current transaction to be ended once flow has stopped on the wild stream. If the value of the recipe inputs changes from 0 to a non-zero value, that recipe will be selected and the transaction will be automatically started.

The recipe select inputs may be used in non-unlimited preset applications. They will function as above except that the recipe may not be changed “on the fly”.

“On the Fly” Blend % and Meter Changes (Cascading Meters)

In the Unlimited Preset mode, the AccuLoad will allow the recipe to be changed while a batch is in progress. The new recipe could select a new blend % to be used from that point on. The new recipe could also select a different meter to be used.

The recipe may be changed while a batch is in progress using the recipe select digital inputs or by using the new NR (new recipe) host communications command.

When a new recipe is selected “on the fly” and a new meter is selected, the valve for the meter no longer desired will be commanded to close and the valve for the new meter will be commanded to open. The blend alarm timer will be reset and the blend alarm will not be checked until the “Blend Alarm Min Volume” amount (Arm 305) has been delivered with the new recipe.

NR (New Recipe) – Host Communications Command

This communications command facilitates selecting a new recipe and automatically starting a transaction using the indicated recipe via communications. If a batch is already in progress, the batch will not be ended but the new recipe will be used from that point on. If a transaction is in progress but the batch is done when this command is received, the AccuLoad will end the current transaction and start a new transaction using the new recipe.

Note: *If a batch is already in progress but has been stopped, the batch will not be re-started by this command.*

This command will override the recipe select digital inputs. If the recipe select inputs change state after this command is received, the recipe select inputs would then override the recipe selected via this command.

This command will only be valid for arms configured for unlimited presetting. Also the communications port control must be set to “poll and program”, “poll and authorize” or “remote control”.

NR RR

Where RR = recipe # (01-50)

The following error responses will be used:

NO01 – in program mode
NO07 – wrong control mode
NO09 – active alarm condition
NO30 – recipe not assigned to arm
NO31 – command not valid for arm configuration

Alarms

When configured for Unlimited Preset with a wild stream product, it may not be desirable to stop the flow on the controlled meters if an alarm condition occurs.

An alarm option "Allow Flow to Continue" is available in the alarm configuration for each alarm. This option will be available for all arm configurations. If it is desirable for the AccuLoad to continue to try to maintain the blend based on the wild stream flow rate during a particular alarm condition, the alarm can be configured to not stop the flow. If an alarm condition is programmed to NOT stop the flow, this will apply to all arms.

Note that Alarms have always had the option to energize an Alarm Output regardless of whether it's configured to not stop the flow. This could be utilized to stop flow on the wild stream through some other means if required.

Also note that any DA (diagnostic) alarm (ex. DA: Flash Error) are not configurable and will always stop the flow.

In the Unlimited Preset mode, the AccuLoad will NOT automatically display the alarm screen for alarms configured to not stop the flow. An alarm condition will be displayed on the status line of the delivery screen and ready screen. There will be no indication of an alarm condition on any of the other screens (ex. dynamic displays, valve opening delay, permissive not met).

If at the dynamic displays while a transaction is in progress and an alarm occurs, the dynamic displays will be automatically exited and the delivery screen will be displayed so that the alarm condition can be seen.

All alarms may be viewed and cleared from the Active Alarms Diagnostic screen.

Proving Controlled and Wild Stream Products

The meter for the controlled product may be proved when in the Unlimited Preset mode of operation. A recipe must be setup using 100% of the desired product/meter.

It is assumed that the meter used by the controlled product is manually isolated and is delivering that product directly through a takeoff to a prover. It is also required that there is no flow from the wild stream product while proving the other meters.

If proving the wild stream meter is required, a control valve on the wild-stream meter can be set up and configured to accomplish this only if the AccuLoad Auto Prove function is enabled (System parameter 321). Meter Flow Control Directory Program code #201 – Valve Type would be set to "Wild Stream" and 2 associated Digital Outputs for this valve would be configured for the Upstream and Downstream solenoids. The flow rate of the wild-stream meter will not be controlled using this valve under normal operation. The valve will be commanded open when the batch is started and will be commanded closed when batch is stopped. If the batch is stopped or an alarm occurs that is programmed to stop flow, the valve would close.

When Auto-Proving is enabled, the flow rate of the wild-stream meter will be controlled using the configured valve through a takeoff to a prover. With the Auto Prove parameter (System 321) enabled, the AccuLoad will prompt for a preset amount. A recipe must be setup using 100% of the desired product/meter. The AccuLoad will then deliver the requested amount using the programmed flow profile parameters (i.e. Arm low flow rate, high flow rate, 1st trip and 2nd trip).

Program Mode Parameters for Wild Stream Blender Features

The transaction must be ended before the program mode can be entered and parameters changed. This will be true whether attempting to make changes via the keypad or via communications.

System General Purpose (Display & Control) Directory

Program code #140 – Stop Key Disable (Wild Stream Only)

-> No
Yes

Help: Select if it is desired to not allow stopping flow using the STOP key (wild stream arms only).

Note: *if enabled, only the arms configured with a wild stream meter will not be stopped when the STOP key is pressed. All other arms will still be stopped.*

Load Arm General Purpose Directory

Load Arm General Purpose Directory
Program code #111 – Unlimited Preset

-> No
Yes

Help: Select if this arm will be used to deliver unlimited amounts (no preset prompt).

Critical: Unlimited preset is available with hybrid load arm configuration only.

Critical: Option not available with bays configured.

Load Arm General Purpose Directory
Program code #112 – Transaction Reset Time

-> 999

Help: Enter the time interval in hours to automatically end and start new transaction (enter 0 to disable).

No-Entry if not programmed for unlimited preset.

Load Arm General Purpose Directory
Program code #113 – Transaction Reset Start Hour

-> 23

Help: Enter the hour of day in military time to start automatically ending and starting new transactions.

No-Entry if not programmed for unlimited preset.

Load Arm Volume Accuracy Directory

Load Arm Volume Accuracy Directory
Program code #304 – Blend Alarm Timeout

-> 999

Help: Enter the amount of time in seconds a blend tolerance error (302) can exist before setting an alarm.

No-Entry if not programmed for unlimited preset.

Note: *A zero value will result in an immediate alarm if blend falls outside of programmed blend tolerance.*

Load Arm Volume Accuracy Directory
Program code #305 – Blend Alarm Min Volume

-> 999

Help: Enter the minimum amount of volume to be delivered before the blend tolerance alarm will be checked. (Checked at the start or re-start of a batch or when a new recipe is started.)

No-Entry if not programmed for unlimited preset.

Load Arm Volume Accuracy Directory
Program code #306 – Blend Correction Volume

-> 999.99

Help: Enter the amount of blend tolerance error in volume units allowed before attempting blend correction.

No-Entry if not programmed for unlimited preset.

Load Arm Volume Accuracy Directory
Program code #307 – Blend Correction Time

-> 999

Range: 1 to 999

Help: Enter the amount of time in seconds to attempt to correct blend errors within.

No-Entry if not programmed for unlimited preset.

Load Arm Volume Accuracy Directory
Program code #308 – Blend Error Reset

-> Batch Start
Blend Alarm Clear
Batch Start & Alarm
No Reset

Help: Select when the current blend error should be reset (at start of batch and/or when blend tolerance alarm is cleared, or never).

No-Entry if not programmed for unlimited preset.

The following new options are available for these existing parameters.

Load Arm Meter Flow Control Directory
Program code #201 – Valve Type

Digital
2-Stage
Analog
-> Wild Stream

Critical: Only sequential meter may be uncontrolled (wild) in hybrid arm configuration.

Critical: Wild Stream is not available with straight, sequential or unloading arms.

Critical: Only 1st meter may be uncontrolled (wild) in ratio and side-stream configurations.

System Alarm Configuration Directory
Program Code 602,603 etc. – Additive Comm Fail

X – Allow Run/Ready Clearing
X – Energize Alarm Relay #1
X – Energize Alarm Relay #2
X – Notify via email
X – Allow Flow to Continue

Config – Digital Inputs Directory
Program codes #301,305 etc. – Input Function

-> Mtr Inj Prove
Recipe Select 1
Recipe Select 2
Recipe Select 3

Note: *the recipe select function will require the arm to be selected, so that recipe select inputs could be setup for multiple arms. The following critical will apply if the recipe select # is assigned to the same arm and to more than one digital input (ex. Recipe Select 1 for arm 1 is assigned to digital input #1 and 2).*

Critical: Input assignments must be unique

Changes to Existing Parameters when using the Unlimited Preset mode

The following parameters are not available in the Unlimited Preset mode of operation and will either be no-entried or have new criticals.

Arm Flow Control

- (221) Clean Line Amount (**Critical:** Not available with unlimited preset mode)
- (224) Ratio Adjust Factor (No-entry)
- (227) Additive Stop Volume (**Critical:** Not available with unlimited preset mode)
- (301) Blend Tolerance % (**Critical:** Not available with unlimited preset mode)

Meter Flow Control

- (207) Overrun Alarm Limit (**Critical:** Not available with unlimited preset mode)

Product Flow Control

- (213) Product Stop Amount (**Critical:** Not available with unlimited preset mode)
- (513) Minimum Back Pressure Flow Timer (**Critical:** Not available with wild stream meter)

Recipe Directory

- 090 Ratio Delivery Mode (**Critical:** Not available with unlimited preset mode)

The following parameters will have new criticals:

Recipe Directory – 004, 006, 008, 010, 012, 014 Component Delivered

- **Critical:** Only one sequential product can be delivered per recipe if arm is configured for unlimited preset.

Example Program Configuration

Below is an example of a possible Wildstream Blender configuration. This example sets up 1 controlled product and one wild stream product.

The blend will be monitored every 1 second (Arm 225). If the delivered amount of the blend product is off by more than 3 gallons (Arm 306), the flow for the product will be adjusted to correct the blend within the next 10 seconds (Arm 307).

The blend will also be monitored for alarm conditions. If the delivered amount of the blend product is off by more than 5 gallons (Arm 302) for 15 seconds (Arm 304), a blend low or blend high alarm will be set. Blend alarms will be ignored for the first 200 gallons (Arm 305) at the start of the batch, after any re-start of a batch or after any "on the fly" recipe changes.

When controlling the flow rate, the AccuLoad will allow the flow rate to vary by 7.0% (Product 204) without making a valve adjustment. If a blend correction is made, the tighter flow tolerance of 4.0% (Meter 208) will be used for 5 seconds (Meter 209).

Configuration Directory

002 Arm 1 Config = Hybrid

003 Arm 1 Product = 2

014 Arm 1 Ratio Products = 1

Load Arm Directory

111 Unlimited Preset = Yes

225 Ratio Factor Time = 1 sec

302 Blend Tolerance (Amount) = 5.0 gal

304 Blend Alarm Timeout = 15 secs

305 Blend Alarm Min Volume = 200 gal

306 Blend Correction Volume = 3.0 gal

307 Blend Correction Time = 10 secs

Load Arm Meter 1 Directory (Controlled Stream)

201 Valve Type = Digital Valve or Analog Valve

208 Flow Adjust Tolerance = 4.0

209 Flow Adjust Timer = 5.0 secs

Load Arm Product 1 Directory (Controlled Stream)

201 Minimum Flow Rate = as specified for meter

202 High Flow Rate = as specified for meter

204 Flow Tolerance = 7.0%

Load Arm Meter 2 Directory (Wild Stream)

201 Valve Type = Wild Stream

Load Arm Product 2 Directory (Wild Stream)

201 Minimum Flow Rate = as specified for meter

202 High Flow Rate = as specified for meter

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