Epic

*3011 Pump Error Handling*

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| --- | --- | --- | --- |
| Version | Date | Name | Comments |
| A | 7/21/2015 | Nate Gerner | Initial revision |
| B | 10/26/2015 | Nate Gerner | Update based on review |
| C | 10/27/2015 | Melanie Cathman | Update based on review |
| D | 11/10/2015 | Nate Gerner | Update based on review, finalize for approval |

# Epic 0010

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| --- | --- |
| Epic ID | ***Typical Workflow*** |
| Epic | As a 3011 Pump user I would like errors automatically handled whenever possible, and I’d like to be informed when it’s not possible. |
| User role | 3011 Pump User |
| Priority | ☒ must have ☐ should have ☐ could have ☐ won't have this time |

## References

Epic 0002- 3011 Pump Screen Navigation

Epic 0001 – 3011 Key Pad and Number Pad

Epic 0003 – 3011 Pump Settings

Epic 0004 – 3011 Pump Tools

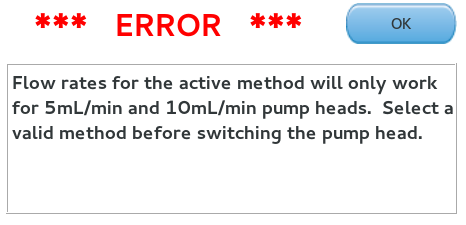
Epic 0006 – 3011 Pump Run Common Controls

NPCFORM\_Verity 3011 Isocratic Pump v1.4.docx

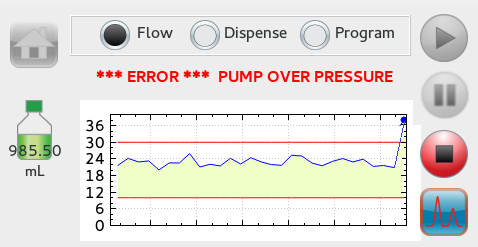
* MR Id 190
* MR Id 340
* MR Id 350
* MR Id 360
* Touch Screen UI and Work Flow Diagrams

## GUI Mock up file

### Error Message Box Screen (Showing Flow Rate Error Message)



### Pump Pressure Error Screen (Showing High Pressure Error Message)



## Standard Workflow

1. Validating User Input
   1. All error-handling of *user input* is handled through the Number Pad and Key Pad.
      1. See ‘Epic 0001 – Key Pad and Number Pad’ for details
2. Verifying Flow Rates in the Active Method
   1. This verification is performed when the user tries to run a method (upon clicking the Run button)
      1. Note: Why? Because the pump’s active method may have been designed for a 10ml/min pump head, and the installed pump head is a 5ml/min
   2. When the pump checks the flow rates of a method, it compares all flow rates in the method to the min/max flow rate ranges of the installed pump head (as set in Tools/Parameters screen).
   3. The flow rates of any linked methods are also checked.
   4. The pump identifies which flow rates are invalid for the method based on the pump settings
   5. If a flow rate is not valid, the Error Message Box Screen is displayed with the message “Invalid flow rate in the following method(s): <Method Names> . Select flow rate between XX – XXX or select appropriate pump head size in Pump Settings” (where XX – XXX is the valid flow rate range for the installed pump head) and the method does not run.
3. Verifying ‘High Pressure Error Method’, ‘Low Pressure Error Method’ and ‘Input 4 Event Method’ Flow Rates
   1. This verification is performed when the user tries to switch the pump head in the Pump Settings screen
      1. Note: Why? Because the pump will start these methods when an Input 4 event / High Pressure Error / Low Pressure Error occurs, and one of these methods could contain flow rates that are only valid for a 10ml/min pump head when the user tries to switch to a 5ml/min pump head
   2. The pump identifies which method(s) contain invalid flow rates.
   3. The flow rates of any linked methods are also checked.
   4. If method(s) contain invalid flow rates, the Error Message Box Screen is displayed with the message “Invalid flow rate in the following method(s): <Method Names> . Select flow rate between XX – XXX or select appropriate pump head size in Pump Settings” (where XX – XXX is the valid flow rate range for the installed pump head) and the method does not run.
   5. The head will not switch if this verification fails (pump head selection will return to the previously selected pump head) .
4. Monitoring Pressure while Pump is Running
   1. High Pressure Limit
      1. If the High Pressure Error Condition checkbox is checked and a valid level is entered in the High Pressure Error Condition textbox (Refer to Epic 0004 – 3011 Pump Tools for details on setting the High Pressure Limit) , the pump will monitor for a high pressure error condition.
      2. If a high pressure error condition occurs:
         1. Flow or Dispense Mode:
            1. An Alarm will sound based on the settings in the Tools/Parameters Tab
            2. The pump will stop the current operations and go to a flow rate of 0
            3. While over pressure, the Pump Pressure Error screen is displayed with the message “\*\*\*ERROR\*\*\* PUMP HIGH PRESSURE” in bold red font.
            4. When the pressure drops below the maximum but is still within 25% of the maximum, the Pump Pressure Error screen displays the message “WAITING FOR LOWER PRESSURE” in bold red font.
            5. The pump returns to the previous run page when pressure drops below 25% of the maximum and the previous operation resumes
            6. The user is still able to press the Stop button to abort the run.
         2. Program Mode:
            1. An Alarm will sound based on the settings in the Tools/Parameters Tab
            2. When no High Pressure Error Condition method is selected, the pump will stop the current operations and go to a flow rate of 0. The Pump Pressure Error screen is displayed with the message “\*\*\*ERROR\*\*\* PUMP HIGH PRESSURE” in bold red font
            3. When a High Pressure Error Condition method is selected, the pump will run that method. The Pump Pressure Error screen is displayed with the message “\*\*\*ERROR\*\*\* PUMP HIGH PRESSURE RUNNING ERROR METHOD” in bold red font

High Pressure limits (as well as Low Pressure Limit, Input Error Condition and Low Volume Limit) will not be considered while the high pressure error method is being run to prevent a continuous loop.

If the High Pressure Error Condition method has a linked method, that method will run after the High Pressure Error Condition method completes.

The run stops after the High Pressure Error Condition method (and all linked methods) has completed.

* + - 1. After run completes:
         1. If an error occurs after a run completes, the pump is stopped (flow rate set to 0 mL/min).
         2. An Alarm will sound based on the settings in the Tools/Parameters Tab
         3. While over pressure, the Pump Pressure Error screen is displayed with the message “\*\*\*ERROR\*\*\* PUMP HIGH PRESSURE” in bold red font.

* 1. Low Pressure Limit
     1. If the Low Pressure Error Condition checkbox is checked and a valid level is entered in the Low Pressure Error Condition textbox (Refer to Epic 0004 – 3011 Pump Tools for details on setting the Low Pressure Limit), the pump will monitor for a low pressure error condition.
     2. Low Pressure Limit is checked 10 seconds after the pump starts pumping.
     3. If a low pressure error condition occurs:
        1. In Flow or Dispense Mode:
           1. The pump will stop the current operation and go to a flow rate of 0
           2. An Alarm will sound based on the settings in the Tools/Parameters Tab
        2. In Program Mode:
           1. An Alarm will sound based on the settings in the Tools/Parameters Tab
           2. When no Low Pressure Error Condition method is selected, the pump will stop the current operation and go to a flow rate of 0
           3. When a Low Pressure Error Condition method is selected, the pump will run that method

Low Pressure limits (as well as High Pressure Limit, Input Error Condition and Low Volume Limit) will not be considered while the low pressure error method is being run to prevent a continuous loop

If the Low Pressure Error Condition method has a linked method, that method will run after the Low Pressure Error Condition method completes.

The run stops after the Low Pressure Error Condition method (and all linked methods) has completed.

* + - 1. After run completes:
         1. If an error occurs after a run completes (while the pump is pumping), the pump is stopped (flow rate set to 0 mL/min).
         2. An Alarm will sound based on the settings in the Tools/Parameters Tab
      2. The Pump Pressure Error screen is displayed with the message “\*\*\*ERROR\*\*\* PUMP LOW PRESSURE” in bold red font.

1. Input Error Condition
   1. If the Input 4 checkbox is checked (Refer to Epic 0004 – 3011 Pump Tools for details on setting the Input 4 Error Condition), the pump will monitor Input 4 event for a ‘Closed’ event.
   2. If an Input 4 event occurs:
      1. In Flow or Dispense Mode:
         1. The pump will stop the current operation and go to a flow rate of 0.
         2. An Alarm will sound based on the settings in the Tools/Parameters Tab
      2. In Program Mode:
         1. An Alarm will sound based on the settings in the Tools/Parameters Tab
         2. When no Input 4 Event Method is selected, the pump will stop the current operation and go to a flow rate of 0.
         3. When an Input 4 Event Method is selected, the current operation will stop and the associated Input Event method will be executed.
            1. Input 4 Events (as well as High Pressure Limit, Low Pressure Limit, and Low Volume Limit) will not be considered while the Input 4 event method is being run to prevent a continuous loop
            2. If the Input 4 Event method has a linked method, that method will run after the Input 4 Event method completes.
            3. The run stops after the Input 4 Event Method (and all linked methods) has completed.
      3. After run completes:
         1. If an error occurs after a run completes, the pump is stopped (flow rate set to 0 mL/min).
         2. An Alarm will sound based on the settings in the Tools/Parameters Tab
      4. The Error Message Box screen is displayed with the message “INPUT 4 EVENT OCCURRED”.
2. Low Volume Error Condition
   * 1. If the Low Volume Error level is valid, the pump will monitor for a low volume error. (Refer to Epic 0006 – 3011 Pump Run Common Controls for details on setting the Low Volume Error).
     2. If Low Volume Error Level is reached while the pump is actively running, the current operations will pause until solution levels have been entered that are above the low volume error value
        1. If running in Program Mode, the pump will pause with or without flow based on the settings in the Tools/Parameters Tab
        2. If running in Dispense or Flow mode, the pump will pause without flow (flow rate will be set to 0 mL/min).
        3. After run completes:
           1. If an error occurs after a run completes, the pump is stopped (flow rate set to 0 mL/min).
     3. An Alarm will sound based on the settings in the Tools/Parameters Tab until solution levels have been entered that are above the low volume error value
     4. The Error Message Box screen is displayed with the message “\*\*\*ERROR\*\*\* LOW VOLUME”.
3. Other Error Conditions
   1. List of Other Error Conditions
      1. When the embedded display receives an error response from the motor control board
      2. When the embedded display process watcher detects that one of the applications has seg-faulted or stopped functioning properly
      3. Any other low-level or embedded error that occurs unexpectedly
   2. When an Other Error occurs:
      1. The pump will attempt to display an error message in the Error Message Box screen.
      2. The pump will attempt to auto-recover, which consists of restarting the application that has failed
      3. If auto-recovery is not possible, the pump will attempt to perform a soft reset
      4. While Running
         1. If an ‘Other’ error occurs while the pump is running, the pump will stop the current operation if possible and the flow rate will go to 0.

## Alternative Workflows

## Acceptance tests

## Open issues

## Communication with other systems