# Smith Meter® microLoad.net™ LACT, Loading and Unloading of Crude Oil applications

Bulletin AB06100 Issue/Rev. 0.0 (8/15)

## OVERVIEW

**Previous to revision 00.21 the microLoad.net has supported LACT, unloading and loading of unrefined products with a rich set of features such as:**

» Temperature averaging with temperature, pressure and density volume compensation per API standards

» Built-in driver access database and cardreader interface to control un-authorized use

» User defined BOL printing to network or serial printer or Ex-proof ticket printer

» Flash memory storage of transaction, event and W&M logs with transaction data spreadsheet

» Operates standalone or controlled through communications (Modbus/Smith)

» Custom driver prompting

**Additional features incorporated into the microLoad.net in revision 00.21 expand and enhance its support for crude oil LACT, loading and unloading applications. This document provides guidance for the use of these new features in typical applications.**

» Diverter valve control including minimum divert time, start-up divert time and maximum number of divert cycles

» Sampler control with parameters to control the output pulse width, grab pacing and sampler can selection

» BS&W monitoring providing  flow weighted average BS&W with settings for the maximum allowed level and the minimum amount of time this level must be exceeded to trigger a divert cycle

» Daily/Weekly/Monthly totals of compensated and uncompensated volumes are available for the current period and the previous period. The hour used for the start of the day is selectable. These totals can be viewed on the display and read out through communications.

» Start/stop with tank level, or key switch, use the front panel keypad or use Modbus/Smith communications command

» Sales pump control with user configurable delay between the time the divert valve is set to the sales position and enabling the sales pump output

» Internal switch to disable non-resettable total reset

» Flow control valve type of "None" that allows the use of these outputs for other functions when flow control is not required

## BS&W MONITORING

**To prevent excessive amounts of water entering the system, the microLoad.net can be configured to monitor the current BS&W level and control a diverter valve based on the that level. The BS&W sensor is connected to the microLoad.net using a 4-20 mΛ analog signal and is configured in the microLoad.net parameter database as follows:**

» In the "Configuration" -> "Λnalog Inputs" section of the configuration database, set the analog input function to BS&W, and the high value (20 mΛ) and low value (4 mΛ) to the range of readings available from the sensor.

» In the Flow Control (LΛCT Features) section of the configuration database, set:

- The maximum allowable BS&W threshold

- To limit spurious divert cycles, set the Divert Delay to set the amount of time the BS&W must exceed the threshold before the microLoad.net will set the divert valve output

- Set the Divert Minimum Time to the amount of time in seconds the divert signal will remain active once it is set in response to excessive levels of BS&W.

- Set the Divert Maximum Cycle Count to the maximum number of times the microLoad.net will perform the divert sequence before an alarm is set and the transaction is stopped.

- The "BS&W Maintenance Value" is used to provide a static value which overrides the live signal during maintenance. For normal operation this value should be set to zero.

**The following diagram illustrates the BS&W monitor processing performed during a transfer:**
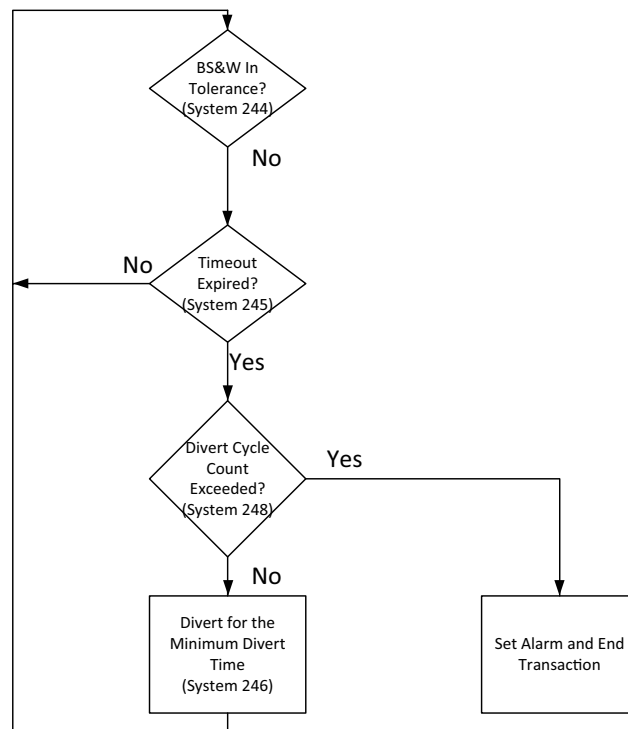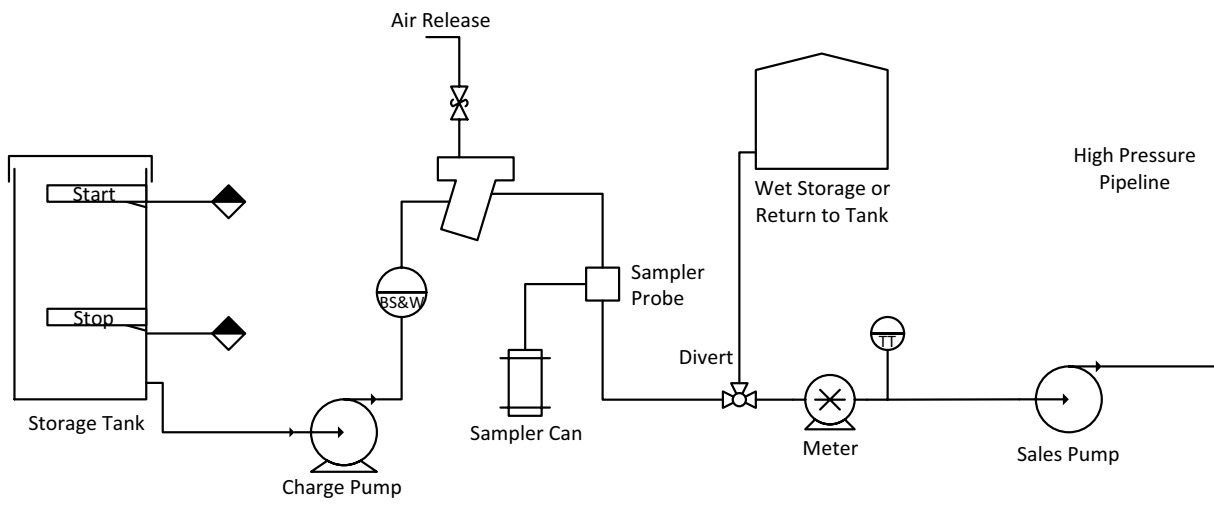


## LACT TO PIPELINE

The schematic, I/O assignment table and flowchart below describes a typical LACT to pipeline application. In this case a transfer is initiated by one of three options, a tank high level switch, an operator (using a remote switch, or via the front panel keypad) or through communications. The microLoad.net controls the sequence by starting the charge pump with the diverter valve initially in the divert position for a programmable time, then if the BS&W is in tolerance, the divert valve will be commanded to the sales position to send oil to the pipe and the sales pump will be turned on after a delay. The transfer is terminated by a signal from the tank low level switch, by the operator (using a remote switch or using the front panel

keypad) or through communications. At the end of the transfer, the microLoad.net turns off the pump(s), prints a bill of lading (if a printer is available) and stores a record of the transaction in long term storage.

If the BS&W levels remain above the threshold for too long (or any other error condition occurs) the microLoad.net posts an alarm and stops the transfer, this may require the operator to clear the alarm at the front panel or the alarm could be cleared through communications before the transfer can continue.

**The operation can be tailored using these parameters:**

» The amount of time the system will spend diverting at the beginning of a transfer is set using the Divert Time at Start parameter

» The BS&W monitoring process is controlled as described previously

» The process can be started using a manual/tank switch input, the front panel keypad or by a communications command. If a manual/tank switch is used, a digital input must be configured with the remote start/stop function to receive the signal from the switch. If the operation is controlled by a communications command, a port (ethernet or serial) must be available. No configuration is required if the operation is controlled using the keypad.

» If the system involves a sampler, a sampler control output is configured, the desired pulse width of the sampler control pulse is selected and the pacing of the output pulses based on the volume totals is set.

» If a sales pump is present, a digital output is assigned to be the control signal and the time delay between setting the divert valve to the sales position and the energizing of the sales pump ouput signal is set.

» If a sampler can full or strainer clogged signal is available, a permissive input function can be configured for a digital input to receive this signal to disable the system based on these conditions
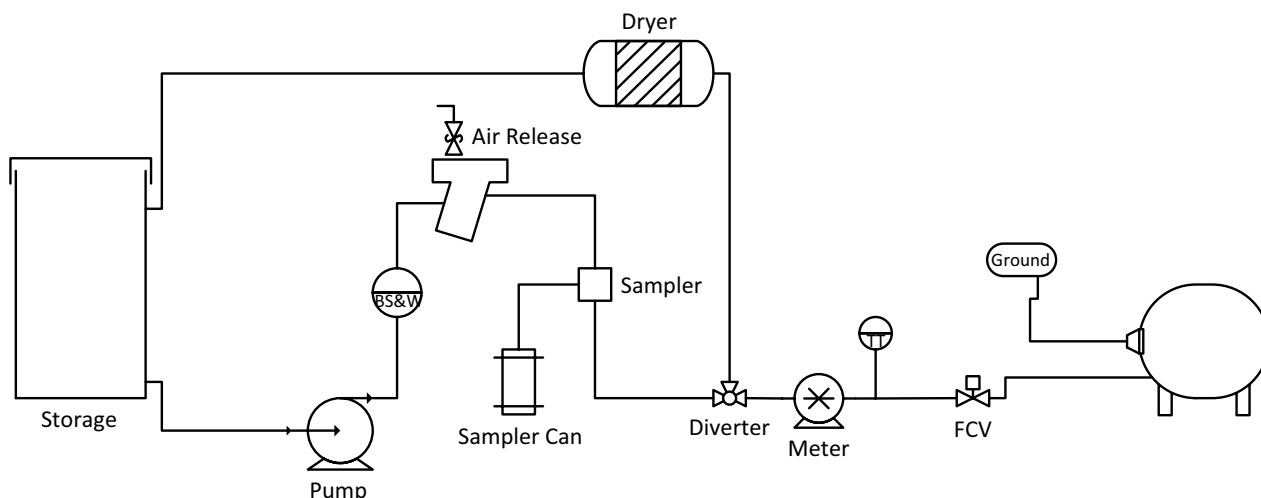


| microLoad.net I/O for a typical LACT to pipeline system (configuration in the parameter database is required) | |
|---|---|
| Pulse In #1 | Meter pulses |
| Pulse In #2 | |
| Analog RTD | Meter temperature |
| Analog 4-20 | BS&W |
| DC Input #1 | Tank Start/Stop |
| DC Input #2 | Optional Permissive |
| DC Input #3 | Optional Permissive |
| AC Output #1 | Charge Pump |
| AC Output #2 | Sales Pump |
| AC Output #3 | Alarm Output |
| AC Output #4 | |
| DC Output #1 | Sampler Grab |
| DC Output #2 | Diverter valve control |
| Pulse Out | |

## TYPICAL LACT TO PIPELINE OPERATIONAL FLOW
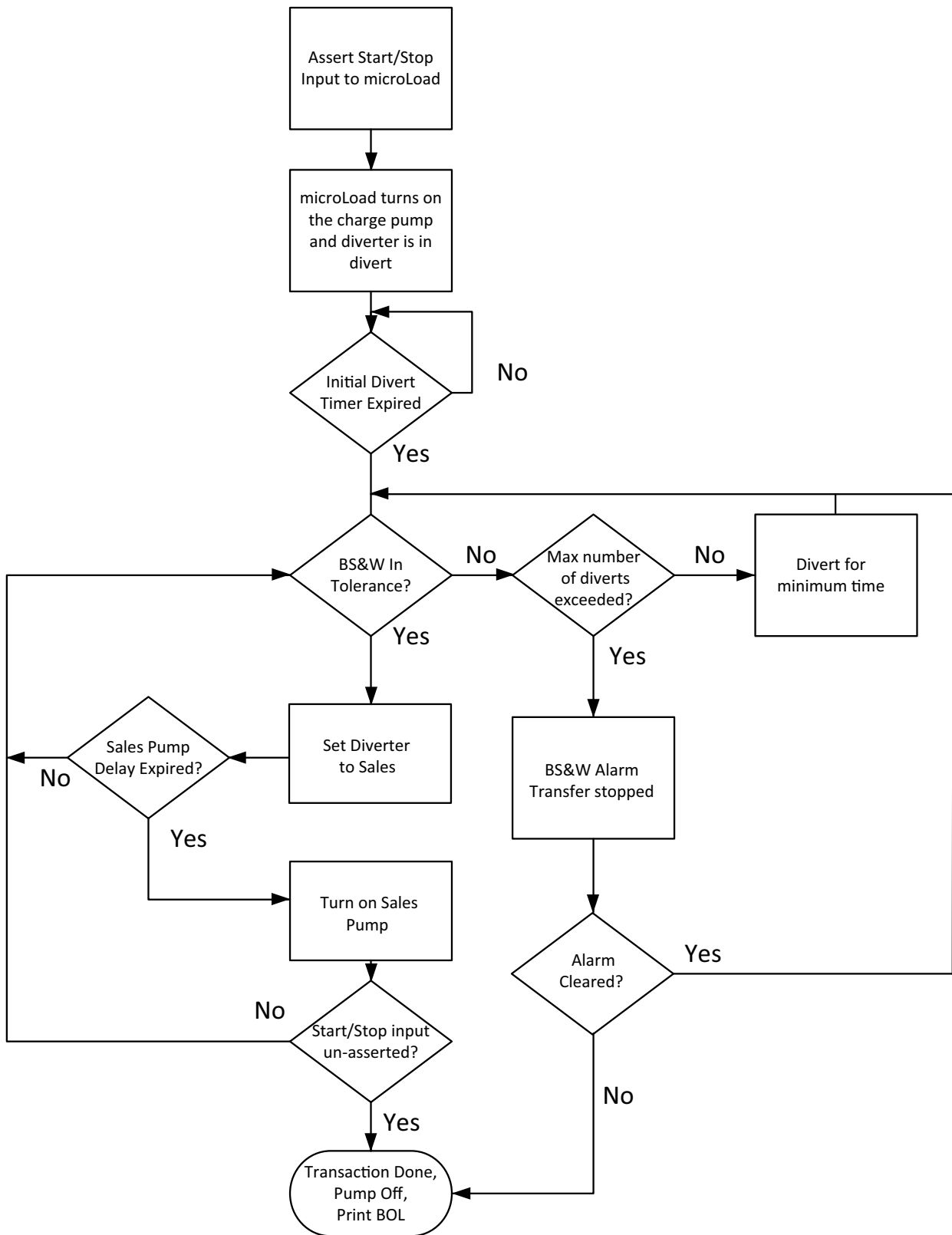
## LACT TO TRUCK / RAIL

The LACT to truck or rail application is similar to a standard preset loading operation with the option to include BS&W monitoring, sampler selection/control and diverter valve control. The schematic, I/O connections and operational flow for a typical system are shown below. In this application the operator will connect the loading hose and ground and then preset the amount to be loaded. Then pressing the start button will enable the pump to begin the transfer and the microLoad.net will monitor and control the delivery process to completion. If the delivery amount is always the same, the transfer can be initiated with a single switch if desired. Upon completion, a record of the transfer is stored in the microLoad.net transaction log and a BOL can optionally be sent to a serial or network printer.



| microLoad.net I/O for a typical LACT to truck/rail system (configuration in the parameter database is required) | |
| --- | --- |
| Pulse In #1 | Meter pulses |
| Pulse In #2 | |
| Analog RTD | Meter temperature |
| Analog 4-20 | BS&W |
| DC Input #1 | Operator Actuated Start/Stop (Optionally via keypad or comm) |
| DC Input #2 | Ground Permissive |
| DC Input #3 | Optional Permissive |
| AC Output #1 | Valve Upstream |
| AC Output #2 | Valve Downstream |
| AC Output #3 | Diverter Valve |
| AC Output #4 | |
| DC Output #1 | Sampler Grab |
| DC Output #2 | Charge Pump |
| Pulse Out | |

The following flow chart describes the microLoad.net operational sequence for a LACT to truck/rail application:
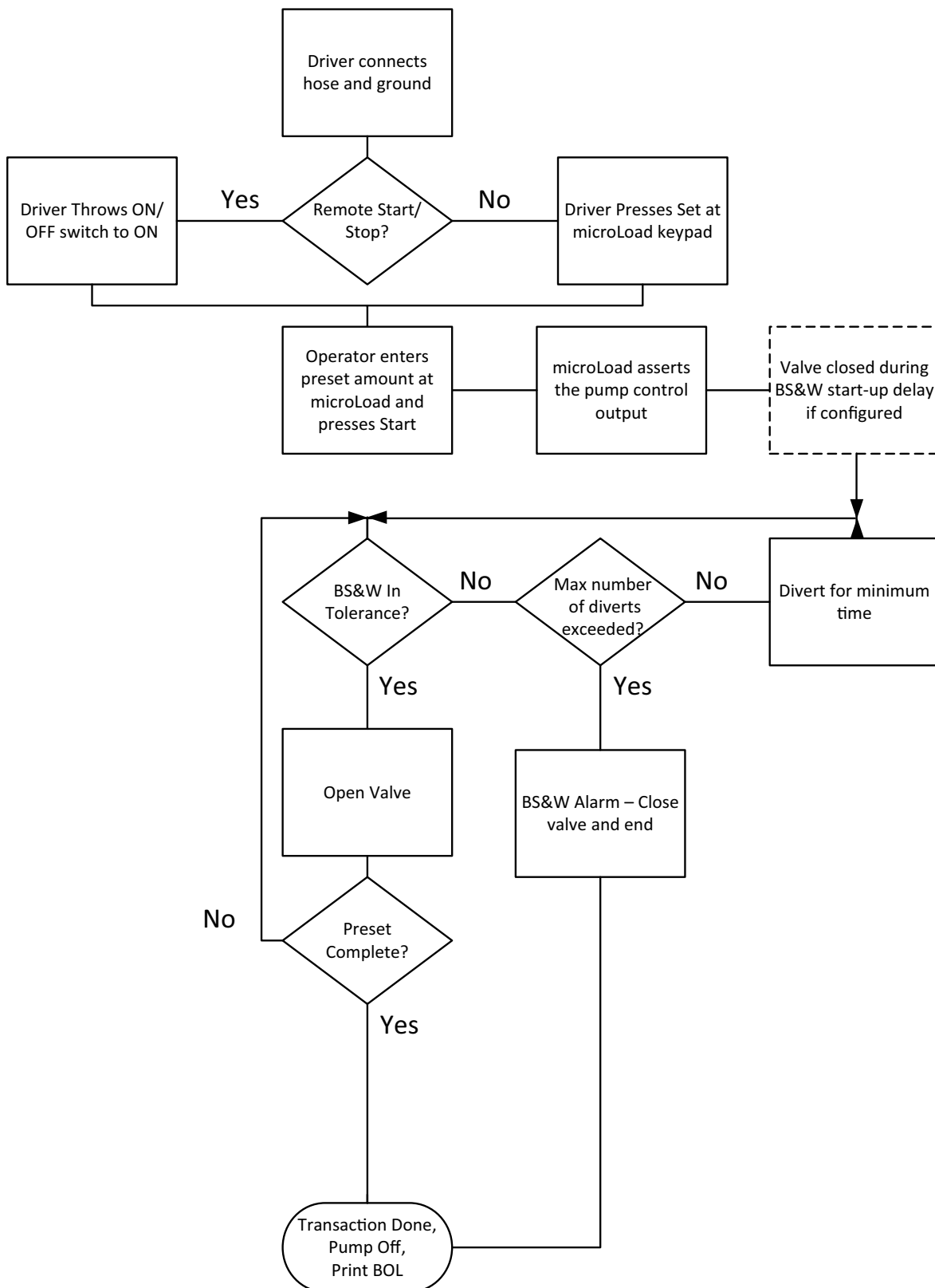
## UNLOADING OPERATION

The schematic, I/O connection table and flowchart below illustrates a typical unloading system. In this application, the microLoad.net can be configured to perform driver access control using its internal driver ID database with or without a card reader. Once validated, the driver would connect the ground and the hose to the truck. If there are multiple sample cans configured, a list of options will be presented on the microLoad.net display and the driver selects the appropriate sampler and initiates the transfer using the microLoad.net keypad. If only one sample can is present, the entire operation can be initiated with a single start/stop switch. By configuring one permissive input to monitor for proper grounding and the second permissive to monitor a float switch for air/liquid, the microLoad.net will control the pump output to perform the transfer safely and accurately. Once completed, the microLoad.net stores a record of the transfer in its transaction log and prints a BOL.
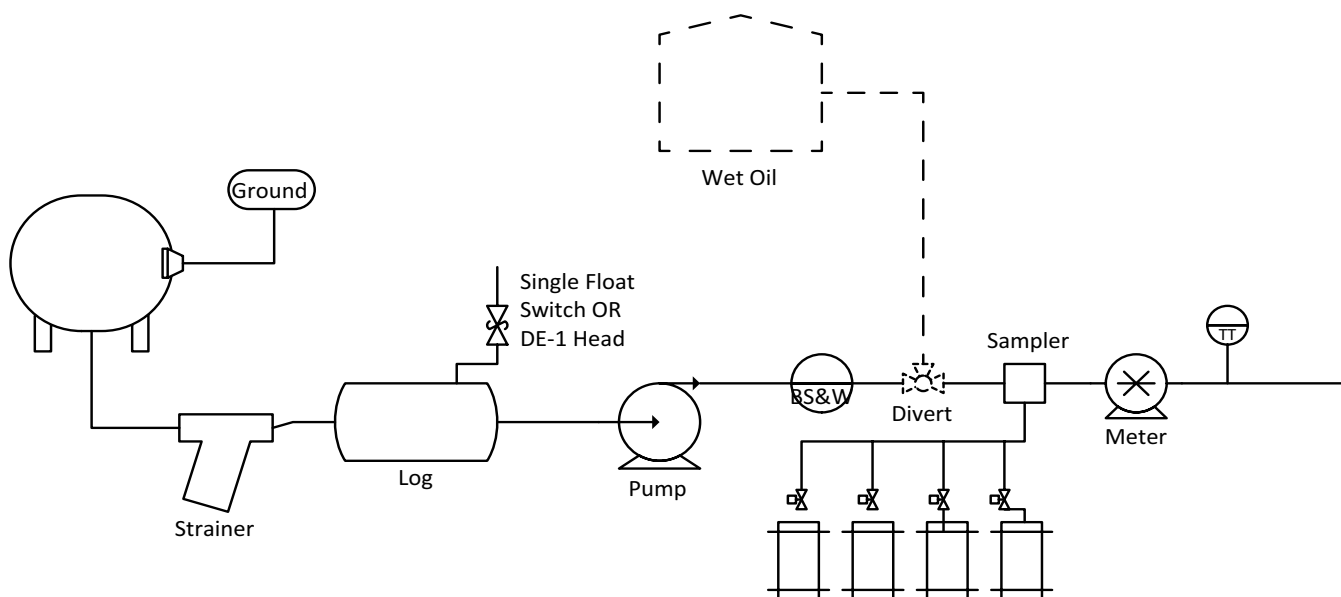


| microLoad.net I/O for a typical unloading system (configuration in the parameter database is required) | |
|---|---|
| Pulse In #1 | Meter pulses |
| Pulse In #2 | |
| Analog RTD | Meter temperature |
| Analog 4-20 | BS&W |
| DC Input #1 | Operator Actuated Start/Stop (Optionally via comm) |
| DC Input #2 | Ground Permissive |
| DC Input #3 | Optional Permissive - Air/Liquid from float switch |
| AC Output #1 | Sample Can Select #1 |
| AC Output #2 | Sample Can Select #2 |
| AC Output #3 | Sample Can Select #3 |
| AC Output #4 | Sample Can Select #4 |
| DC Output #1 | Sampler Grab |
| DC Output #2 | Pump Control |
| Pulse Out | |

# TYPICAL UNLOADING OPERATIONAL FLOW
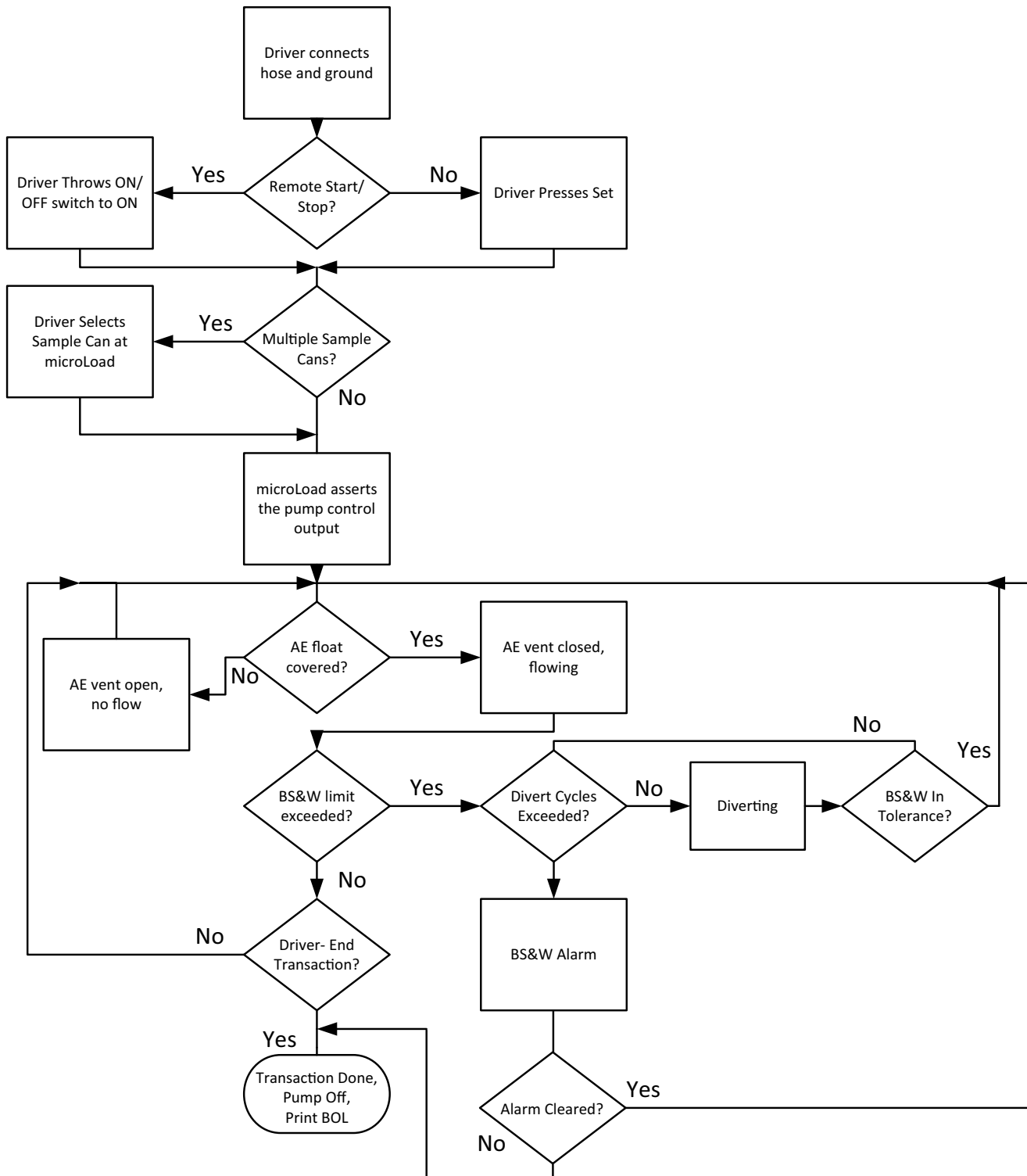
# APPENDIX A – Parameter Details

## REVISION 00.21 CHANGES TO CURRENT CONFIGURATION PARAMETERS

**Digital Output Functions**
New options in the list of available digital output functions as shown:

|      | Additive Pump 3 |
|------|-----------------|
|      | Additive Pump 4 |
| -> | **Diverter** |
|      | **Sampler Pulse Out** |
|      | **Sampler Sel 1** |
|      | **Sampler Sel 2** |
|      | **Sampler Sel 3** |
|      | **Sampler Sel 4** |
|      | **Sale Pump** |

New critical error check (for Diverter, Sampler and Sale Pump options): Functions must be unique.
New critical for Diverter: BS&W probe must be configured

**Configuration Directory, Analog Input #2 Function (Parameter 411)**
An option in the list of available analog input functions as shown:

|      | NA |
|------|-----|
|      | Temp In |
|      | Dens In |
|      | Press In |
| **->** | **BS&W In** |

## GENERAL PURPOSE 201 – VALVE TYPE

An option in the list of available valve types as shown:

|      | Digital |
|------|---------|
|      | Two Stage |
| **->** | **None** |

## NEW PROGRAM MODE PARAMETERS

Program parameters added to Program Mode in revision 00.21 are as follows:

**System General Purpose Directory 133 – Interval Totals Start Hour**
Range: 00 - 23
Help: Enter the hour of day when the daily total is reset (00=midnight)

**System Flow Control Directory 241 – Sample Rate**
    Range: 0.000 – 9999.99
    Help: Enter the amount of product delivered between sampler grabs
    No Entry: no sampler output configured (no entry Sampler sub-menu)

**System Flow Control Directory 242 – Sampler Minimum Pulse**
    Range: 1 – 99
    Help: Enter the minimum pulse width (high time) in 1/10th second increments
    No Entry: no sampler output configured (no entry Sampler sub-menu)

**System Flow Control Directory 243 – BS&W Maintenance Value**
    Range: 0.00 – 9.99 (percent)
    Help: Enter the percentage sediment and water to use as a maintenance value in case of probe failure.
    No Entry: no BS&W probe configured

**System Flow Control Directory 244 – Divert Percentage**
    Range: 0.00 – 9.99
    Help: Enter the maximum allowable BS&W percentage before diverting.
    No Entry: no BS&W probe configured, no diverter output configured

**System Flow Control Directory 245 – BS&W Time Before Divert**
    Range: 00 – 999 (seconds)
    Help: Enter the time in seconds the BS&W limit must be exceeded before the microLoad.net.net will transition to Divert mode.
    No Entry: no BS&W probe configured, no diverter output configured

**System Flow Control Directory 246 – Minimum Divert Time**
    Range: 00 – 999 (seconds)
    Help: Enter the minimum time in seconds the diverter valve will stay in the divert position prior to re-checking the BS&W level.
    No Entry: no BS&W input configured, no diverter output configured

**System Flow Control Directory 247 – Divert Time at Start**
    Range: 00 – 999 (seconds)
    Help: Enter the time in seconds to keep the diverter valve in the 'divert' position when the system is started/restarted.
    No Entry: no diverter output configured

**System Flow Control Directory 248 – Divert Cycle Count Alarm Limit**
    Range: 00 – 99
    Help: Enter the maximum number of divert cycles that may occur before an alarm is generated.
    (max divert time = this value times the minimum divert time in System 435)
    No Entry: no BS&W input configured, no diverter output configured

**System Flow Control Directory 249 – Sale Pump Delay to On**
    Range: 00 – 99 (seconds)
    Help: Enter the time in seconds to wait once the BS&W value is within the allowable limit (i.e. from the time that the diverter valve is commanded to the Sale position) before engaging the Sale pump.
    No Entry: no BS&W input configured, no sale pump output configured

A submenu in the System Flow Control directory provides access to these parameters:

        Flow Control Dir
        201 Valve Type
        Flow Profile
        Alarms Limits
        Delays/Timers
  ->     LACT Features

## NEW RUN TIME VARIABLES IN REVISION 00.21

Additional run-time variables to the microLoad.net.net run-time database to maintain interval totals for all volume types, and live and load average BS&W:

        Current/Previous Hour
        Current/Previous Day
        Current/Previous Week
        Current/Previous Month
        Live BS&W
        Avg BS&W

The definition of these time periods is:

        Day – 24 hour period starting at a programmable start hour (NOTE:  Only the hour can be selected, not the minutes).
        This is a  new parameter in the configuration database with a range of 0-23.
        Week – Week starts on Sunday at the hour selected for the start of the day.
        Month – Month starts on the first day of the month at the hour selected for the start of the day.

## ALARMS ADDED IN REVISION 00.21

The microLoad.net will support the following additional alarms:

627 – Divert Timeout (DT) Alarm
644 – BS&W Probe Fail (BS) Alarm

**Dynamic Display values**
Interval Totals
Sampler status - current can in use, current grab count

**Diagnostics Pages**
The BS&W probe value (as a percentage) is viewable in the Analog Inputs diagnostic if configured as such.

www.GuidantMeasurement.com