Spartan Controls Ltd.
Truck Unloading System FB107
Operation Manual for Pro-Face Display

Revised August 2020

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Contents

1.0 INTRODUCTION

This document is designed to assist technicians and operators in the operation and maintenance of the Truck Unload Panel. If a problem arises that is not covered within this manual, please call Spartan Controls. Spartan Controls offers full service and support of this product. For service and/or assistance please call Spartan Controls, Measurement Instrumentation Service department (780) 468-5463.

This manual describes the operation of the Spartan Controls' Truck Loading / Unloading system model TUS FB107. The TUS FB107 is designed to measure quantities of fluids trucked in or out of oil batteries.

The system provides the user with a display for real time flow rates, flow totals, density, temperature, water cut and unloading time, while the truck is unloading. After the truck is done unloading the system prints out a multi-copy ticket with date, time, trucking company, well LSD, unload time, temperature, water cut, oil and water totals, and total volume. The volumes are corrected to 15 degrees C using methods defined by API Chapter 11.1 (American Petroleum Institute).

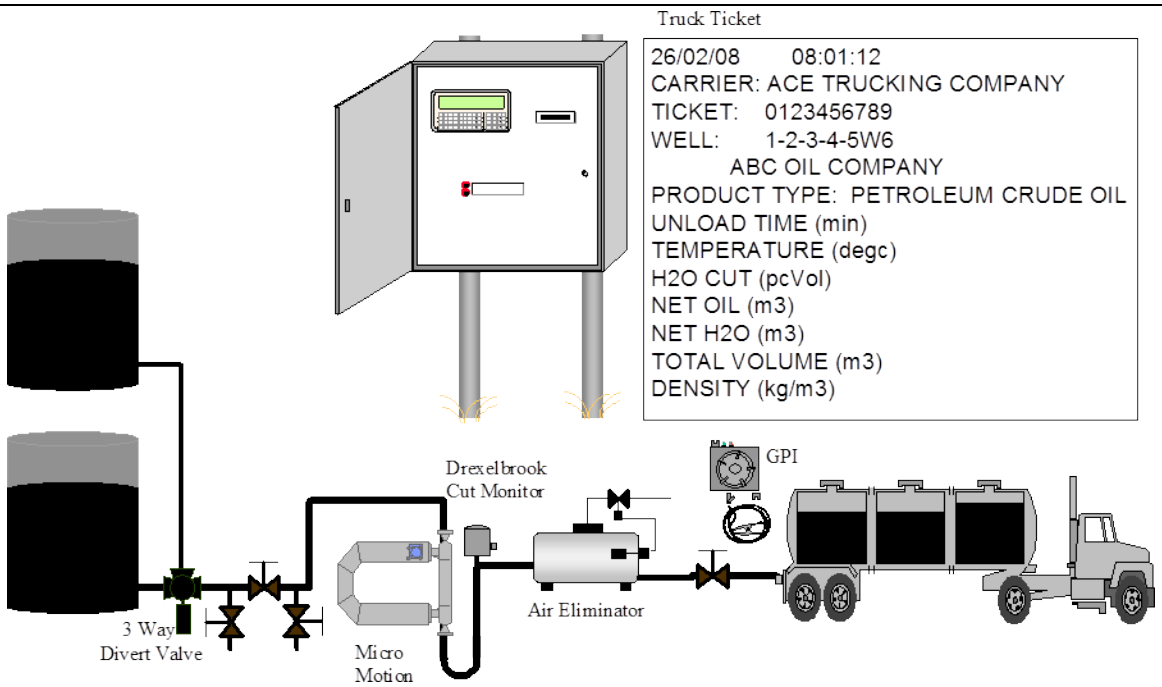
The basic system consists of an FB107 Truck Unload Interface panel, Micro Motion mass flow meter, Drexelbrook Water Cut Monitor or a Phase Dynamics water cut analyzer. The system uses specially developed software based on the Chevron patented net oil calculation to perform the NOC calculations, and Spartan Controls' patented Density Compensated Water Cut Calculation.

The FB107 receives signal inputs from the Micro Motion mass flow meter, Drexelbrook Cut Monitor, Phase Dynamics water cut analyzer and calculates the standard volumes completion of the unload process.

The TUS FB107 has the following short-term internal database:

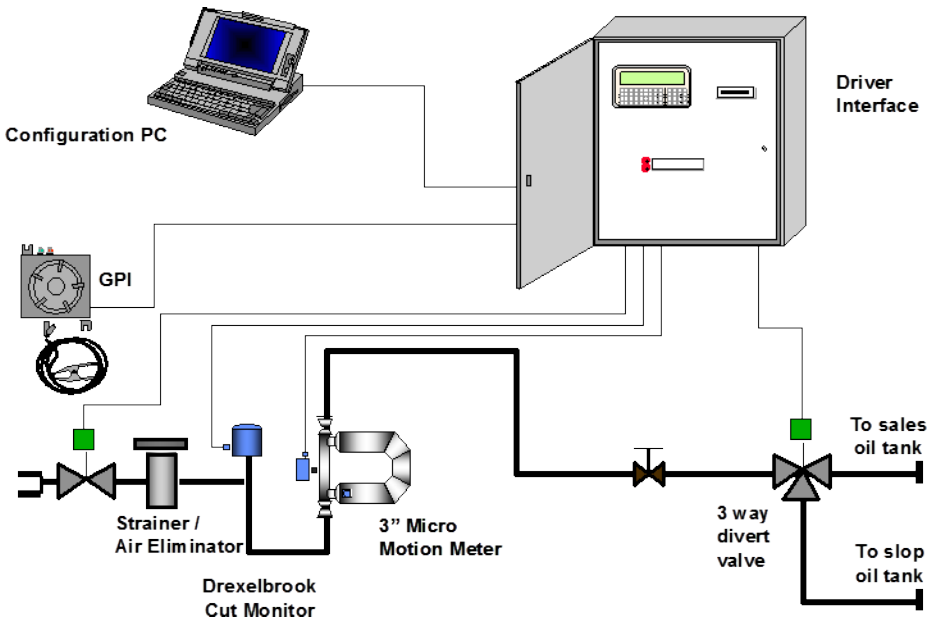
Locations	200
Trucks	100
Tickets	140
Datalogger Unloads	Last 8 loads
Datalogger records	250 records

The system also has long term ticket and data logging saved to a local flash drive.
The basic Truck Unload System is shown below, this is a typical diagram and layout can vary depending on construction and options selected. When used as a Transloader the system unloads directly to rail car.


Truck Ticket
26/02/08 08:01:12
CARRIER: ACE TRUCKING COMPANY
TICKET: 0123456789
WELL: 1-2-3-4-5W6
ABC OIL COMPANY
PRODUCT TYPE: PETROLEUM CRUDE OIL
UNLOAD TIME (min)
TEMPERATURE (degc)
H2O CUT (pcVol)
NET OIL (m3)
NET H2O (m3)
TOTAL VOLUME (m3)
DENSITY (kg/m3)
Drexelbrook
Cut Monitor
GPI
3 Way
Divert Valve
Micro
Motion
Air Eliminator

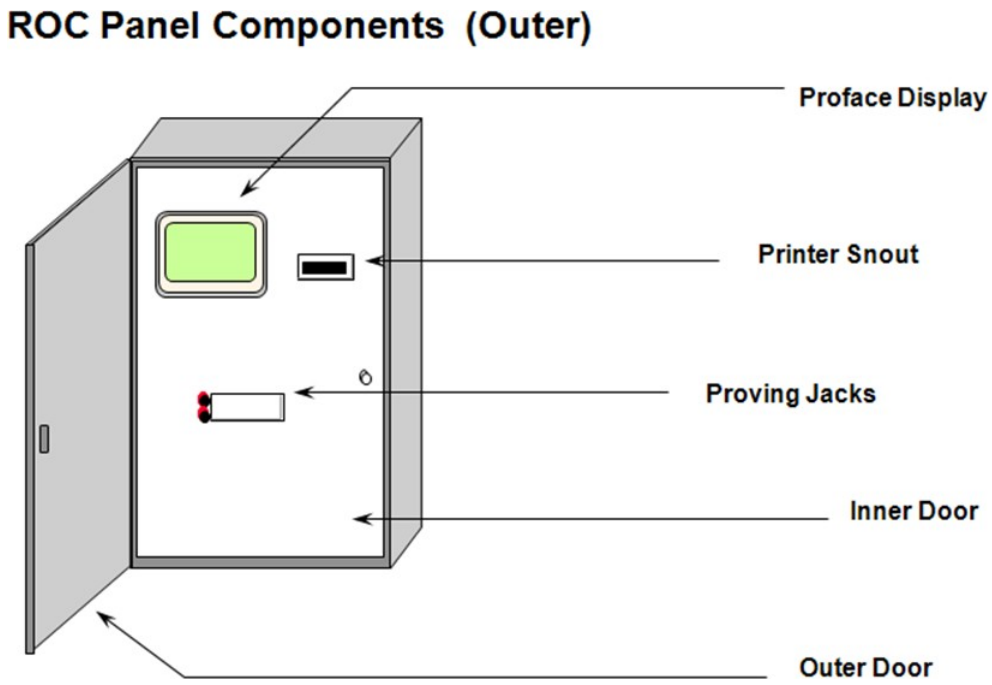
2.0 SYSTEM COMPONENTS

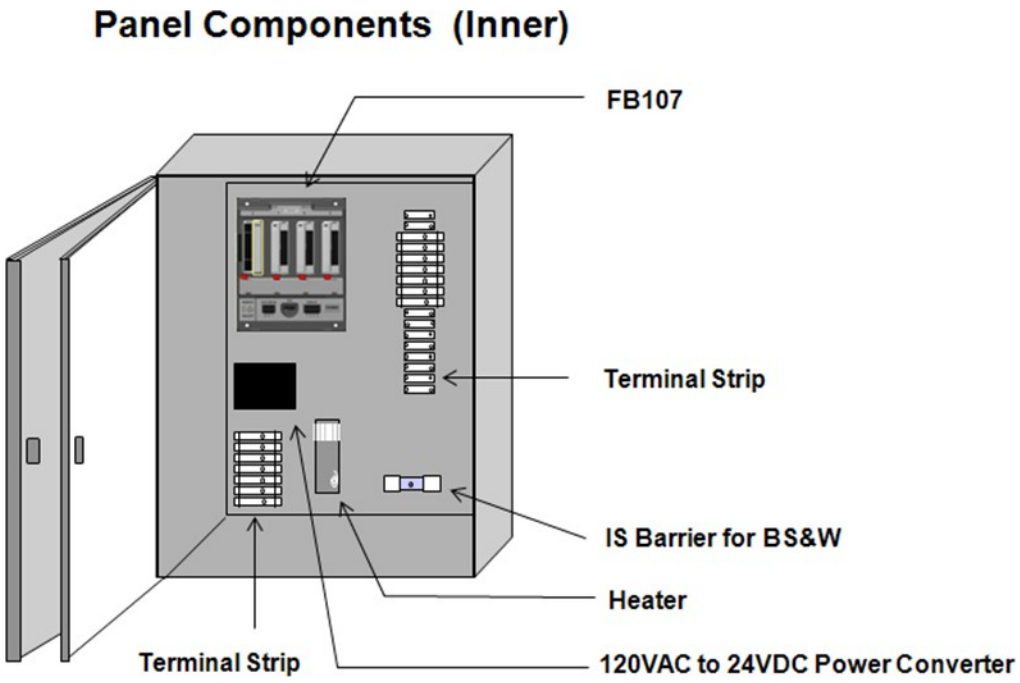
The Spartan Controls TUS FB107 Truck Unloading system uses a FB107 as the central controlling device. The FB107 is connected to the Micro Motion mass flow system through the 2500, 2700 transmitter. The inputs are supplied by modbus or pulse & analog signals. The Micro Motion sensor is installed in the flag position to allow proper operation should gas slugs be present in the flow stream. The Micro Motion sensor connects to the Micro Motion transmitter with a 4-wire communication cable. A Drexelbrook cut monitor or Phase Dynamics water cut analyzer is used to improve water cut accuracy. If using the divert option the cut monitor has to be included for improved water cut resolution. This cut monitor measurement is supplied by a 4-20mA analog signal. An optional Ground Permissive Interlock (GPI) can be added to insure the truck is properly grounded for safe unloading. The GPI signal is supplied to the FB107 as a discrete input. An optional 3-way divert valve can be used to divert dry oil directly to the sales oil tank avoiding reprocessing fees. All configuration of the database is completed by either the driver interface or a PC (not supplied with system). The PC can be also be used to extract historical load data and perform diagnostics. After configuration is complete all driver interaction is with the local display interface only. The system will print an unload ticket at the completion of the unload process. Data from the unload is stored in the system for historical data access. The system stores 200 well locations, 100 trucking companies and the last 140 unloads. The system also stores 250 data points from the last 8 unloads for unload data analysis. An overview of the system is shown below.



2.1 TUS FB107 Panel

There are a number of internal components in the FB107 panel.





The following information gives a brief overview of all internal components.

2.1.1 FB107

The FB107 is the main component of the Truck Unload Panel, it provides the processor to run the User C software. All data is received, processed, saved and sent to the printer by the ROC. The ROC also is the I/O interface to the associated field instruments. All data stored in ROC is battery backed to ensure that no data is lost during power outages. The hardware overview is shown below.

2.1.2 STAR PRINTER

The printer is a Star SP500. The maintenance requirements of the printer includes: ribbon replacement, paper replacement, and communication testing. All supplies including 1 or 2 copy paper, and ribbon (purple or black) can be supplied by Spartan Controls. The common parts required are:

Printer Paper #RF-3.25-2P Double Copy paper
Printer Ribbon #RC-300P Printer Ribbon (purple)

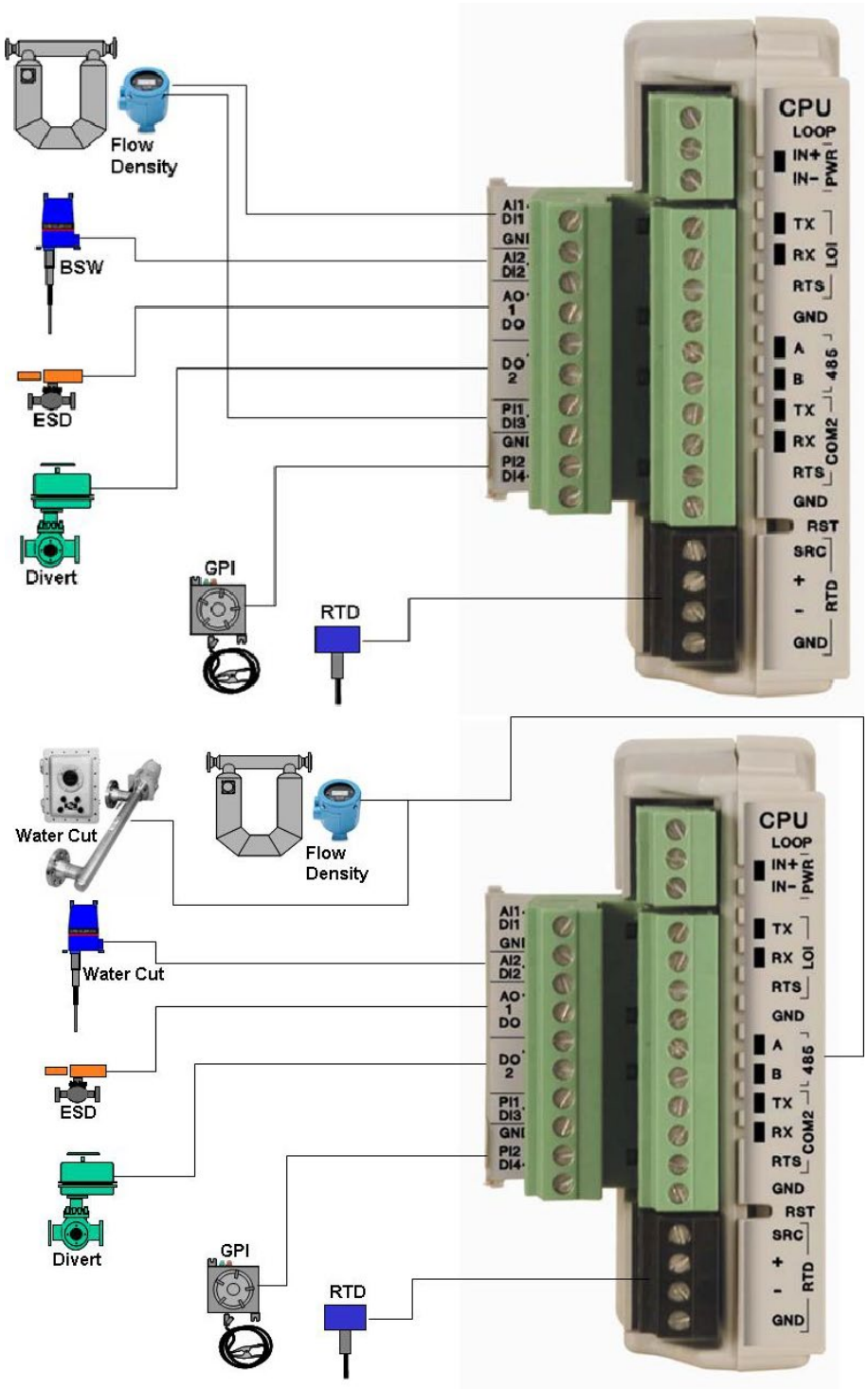
Refer to the Troubleshooting section of printer manual for further assistance.

2.1.3 Pro-Face Display

The Pro-Face display is used for driver identification entry and for displaying process information.

I/O

The TUS FB107 can be configured with I/O to the Micro Motion meter or modbus communications. The preferred method is modbus communications. The following illustrates the wiring for both options along with the other I/O requirements:



2.2 CONFIGURATION PC

Database configuration changes and historical data access for the FB107 are made with a standard PC running Spartan Controls TUSPHD software or changes can be made from the Proface display. There are 2 PC programs that can be used to interface to the system:

- TUSPHD - PC Program for Configuration and Database Management
  The TUSPHD program was written specifically for the FB107 system. The program runs on Windows operating systems. The program allows for configuration changes, data management and data logging functionality.
- ROCLINK - PC Program for Configuration of FB107
  The ROCLINK program from Emerson runs on Windows operating systems. The program allows for configuration changes of the software, I/O and communications settings.

2.3 MICRO MOTION METER

The Micro Motion meter consists of a sensor that goes in the flow line and a transmitter that processes data and provides output signals. The flow sensor used for truck unloading systems is usually a model CMF300. The transmitter can be either an RFT9739 (MVD), 2500 or 2700.

See below

			
CMF300	RFT9739	2500	2700

The Micro Motion transmitter provides measurement by modbus or a pulse output representing volume flow and analog outputs representing density. Temperature should be provided by a remote mount RTD or temperature transmitter. Once the Micro Motion sensor is installed and the transmitter is working properly, a zero calibration should be performed. The flow meter zeroing offsets any noise or vibration that may cause a flow signal. The offset ensures accurate measurement of "zero flow" through the meter. All initial setup and zero flow calibration of the Micro Motion meter should be performed by

a Spartan Controls service technician. Additional details can be located in the Micro Motion instruction manual available.

2.4 DREXELBROOK CUT MONITOR

The Drexelbrook cut monitor is an inline device that measures low concentrations of water in hydrocarbon. The Universal IV electronics is used to provide digital signal processing of the signal. The cut monitor provides a 4-20mA representing 0-5% water cut to the FB107. The water cut signal from the Drexelbrook is uncorrected for temperature and density effects. The signal is corrected in the FB107 resulting in a fully compensated water cut measurement. The calibration of the cut monitor is based on the density range of incoming liquids. The calibration must be calculated and performed by a Spartan Controls technician. Additional details for Drexelbrook can be located in the instruction manual.

2.5 TEMPERATURE TRANSMITTER

An external temperature measurement is required to comply to Directive 17 accuracy requirements. The recommended measurement is by an in line RTD that can be wired directly to the FB107. A temperature transmitter can also be used in place of the RTD and feed into the FB107 by an analog input signal.

2.6 GROUND PERMISSIVE INTERLOCK (GPI)

The ground permissive switch prevents trucks from unloading if they are not properly grounded. If the truck is grounded properly continuity is achieved between the two wires at the clamp. This closes a contact and sends the ROC a discrete high signal which allows the driver to proceed with the unload. If the truck is not grounded properly the ROC receives a discrete low and system will not allow proceeding until the clamp is properly secured. The input is normally off and will only start with a properly grounded circuit.

The unload process will not he halted if continuity is lost during unloading.

2.7 3-WAY DIVERT VALVE

A 3-way divert valve can be used to divert dry oil to the sales oil tank and reduce reprocessing fees. It is recommended to use a 3-way valve instead of 2 individual valves for safety reasons. Using a 3-way valve will prevent the possibility of blocking the flow incase actuator failure occurs. If flow is blocked the result is generally an oil spill due to over pressuring of the truck hose. The divert valve is controlled by a DO signal from the FB107.

2.8 INLET BLOCK VALVE

A BLOCK valve can be used to prevent unloading access without proper identification and grounding. The ESD valve is controlled by a DO signal from the FB107.

2.9 AIR ELIMINATOR

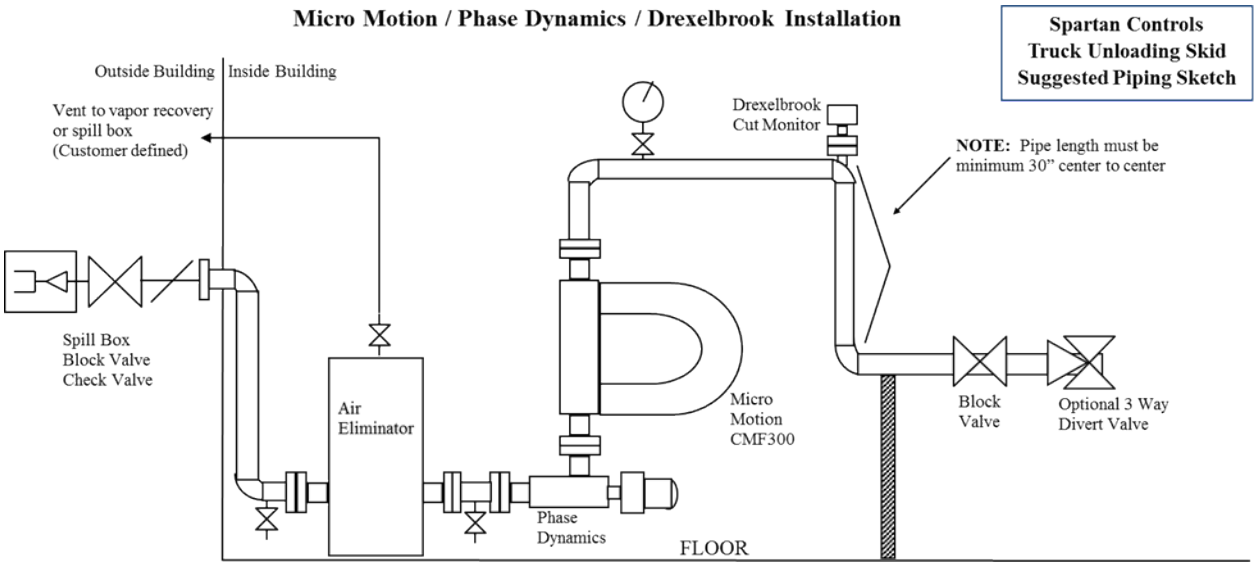
An eliminator is required for truck unloading installations per Directive 17 installation guidelines for truck unloading. The air eliminator will reduce or eliminate any gas slugs at the beginning and end of the unloading process. The air eliminator is a small separator that allows liquid to pass through and gas to vent from the top. The gas can be vented to a storage tanks or the vapor recovery system.

3.0 INSTALLATION

The following section details the installation of the major hardware components. It is recommended that this section is followed closely to ensure that the system will work as designed. If there are any problems with installing the equipment as shown, or if there are any questions, please contact Spartan Controls MI Dept. at (780) 468-5463.

3.1 OVERALL SKID UNIT

The typical skid unit layout is illustrated as follows. Micro Motion mass flow system consists of two parts, a sensor and a transmitter. The sensor should be installed in the flag position as illustrated below. In some installations the Phase Dynamics and 3-way divert valve are installed optionally. For wiring details please consult the wiring prints supplied by Spartan Controls.



The Micro Motion RFT9739 or 2700 transmitter can be mounted in the unloading building or pipe stand mounted near the driver interface box. If using a model 2500 transmitter it should be DIN rail mounted in the unloading panel.

3.2 FB107 TUS Panel

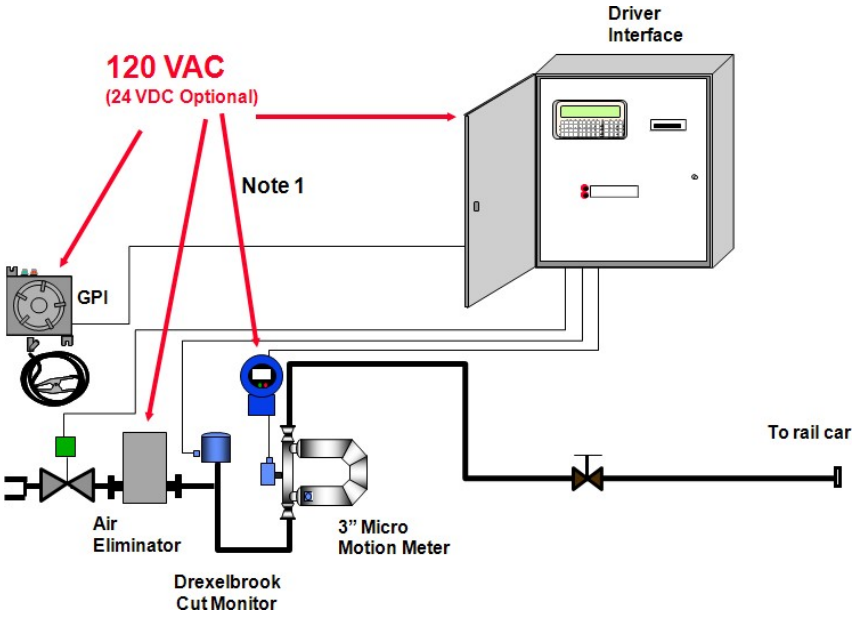
The enclosure is designed for installation in a Class 1 Division 2 location and is rated NEMA 4 so it can be mounted outside. The panel's outer door should remain closed in sub-zero temperatures to maintain proper temperature inside the panel.

4.0 Wiring

4.1 Power Wiring Overview

Panel Power Requirement: 120 VAC 15 Amp service

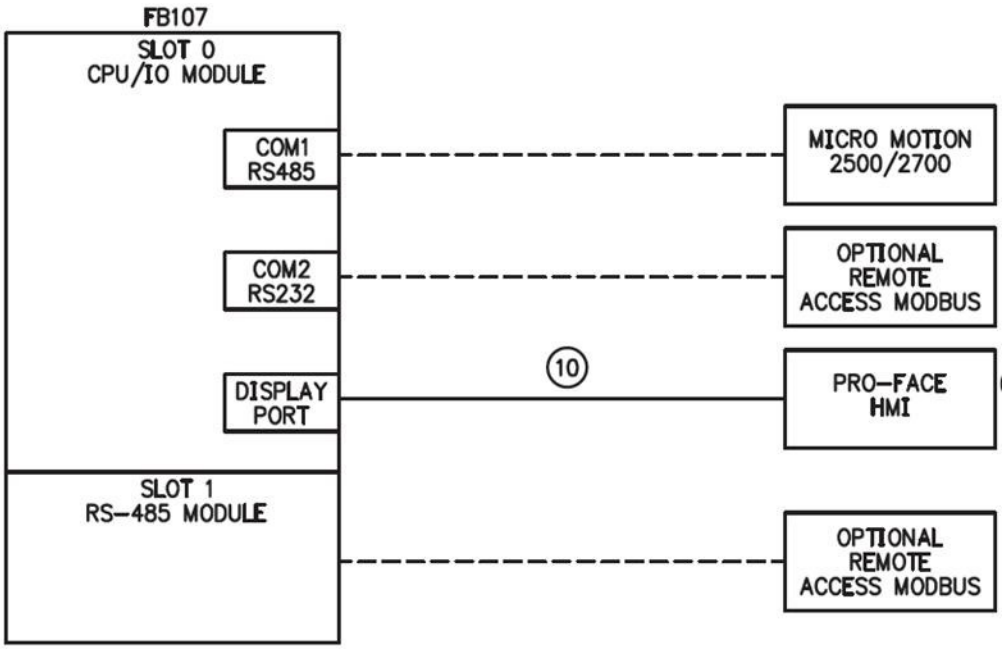
The panel requires a 120 VAC source. The following illustrates the overall system wiring for clarification.



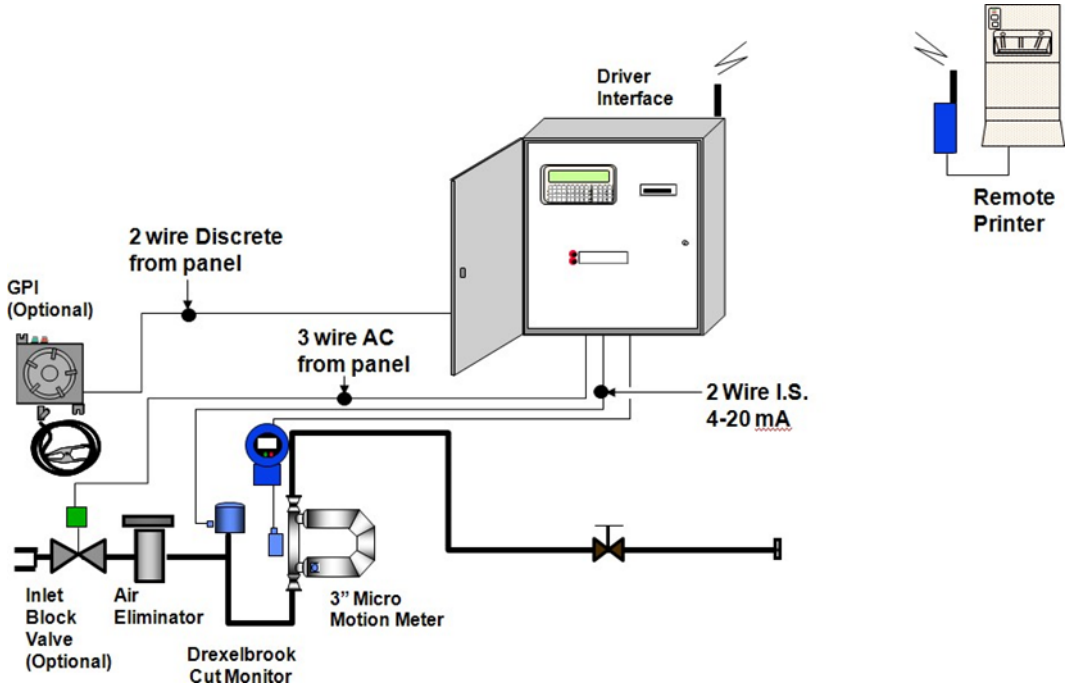
Item	Signal Type	Signal Represent	Wiring Responsibility	Wiring / Power Requirement
Truck Unload Panel	Power Input		Customer	120VAC, 60Hz, single phase (15 amp)
	Modbus	Micro Motion Flow & Density	Customer	2 Wire Communication

	Analog Inputs	BS&W	Customer	24VDC, 4-20 mA (Sourced by panel)
	RTD	Temperature	Customer	3 Wire Input
	Discrete Input	Ground Permissive	Customer	Dry contact SPST (Sourced by panel)
	Discrete Outputs	ESD Valve Water Alarm	Customer	Dry contact DPDT, 120VAC or 24VDC (Sourced by panel)
Drexelbrook BS&W	Analog Output	Water Cut	Customer	4-20 mA, I.S. (Sourced by panel)
Ground Permissive	Power Input		Customer	120VAC, 60Hz, single phase
Micro Motion CMF300M Sensor	Power & Communication I.S.	Process Measurements & Diagnostics	Customer	Hardware dependant 4 wire communication (Sourced by Micro Motion transmitter)
Micro Motion Transmitter	Power & Modbus	Flow & Density	Customer	Hardware dependant Modbus communication (Sourced by panel)
ESD Valve	Power Input		Customer	120VAC/24VDC depends on valve selection (Sourced by panel)

Panel Communication Wiring Overview



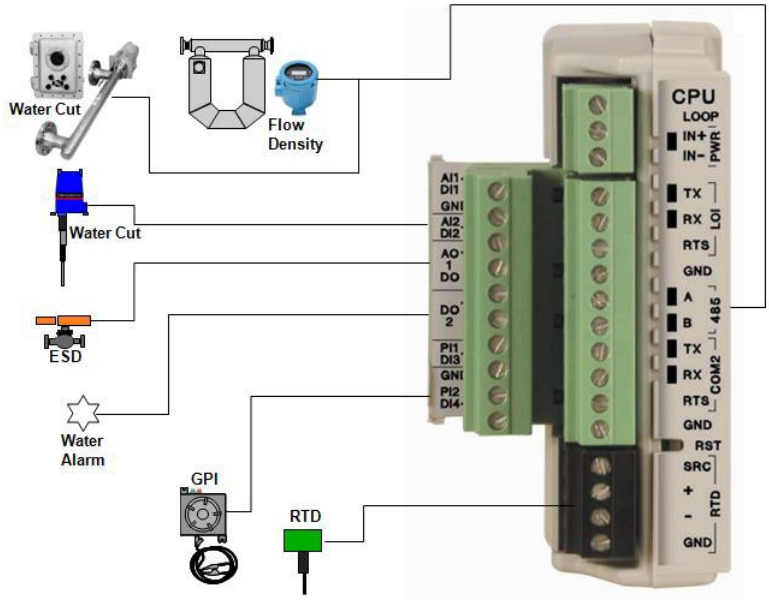
Field Wiring Overview



4.2 Field Wiring

Note: Micro Motion (Density, Temperature and Volume Flow) wiring may vary depending on transmitter model and mounting location. Consult Spartan Controls for questions.

There are 2 standard wiring options used. The preferred method is using the second illustration where the Micro Motion is wired for modbus communications.



5.0 Configuration

Technicians use the following programs for system configuration and calibration:

- PROLINK 2 MMI CONFIGURATION
- HARTWIN DREXELBROOK CONFIGURATION
- TUSPHD PC PROGRAM FOR CONFIGURATION OF TUS SOFTWARE
- ROCLINK PC PROGRAM FOR CONFIGURATION OF FB107

The operator of the system should only require the TUSWIN program for configuration, data access and maintenance.

5.1 Configuration of FB107

The Drexelbrook is always wired to AI-2, AI 2 Slot 0.
The Ground Permissive Dry Contacts must be always wired to DI-4, DI 4 Slot 0.

If the Meter SFP Landing is set to “0 = Disable Polling” then the I/O Assignment from the meter will be:

Meter Density in g/cc 4-20 mA wired to AI-1, AI 1 Slot 0.
Flow Temperature in Deg C must be wired to RTD input AI-3 AI 1 slot 0

Flow Pulses from Meter wired to PI-1, PI 1 Slot 0.

If the PhaseDynamic SFP Landing is set to 0 then the Phase Dynamics logic is ignored, there are no AINs available for the Phase Dynamics. Polling address’s are:
MMI modbus polling = 1 PDI modbus polling = 11

Analog Inputs

Variable	Units	Range	Scan Period	Filter	
Density	g/cc	0 to 1.6	0.5 s	3	
Temp	Deg C	-20 to 140	0.5 s	3	
Cut	Dielectric	Calculated	0.5 s	3	

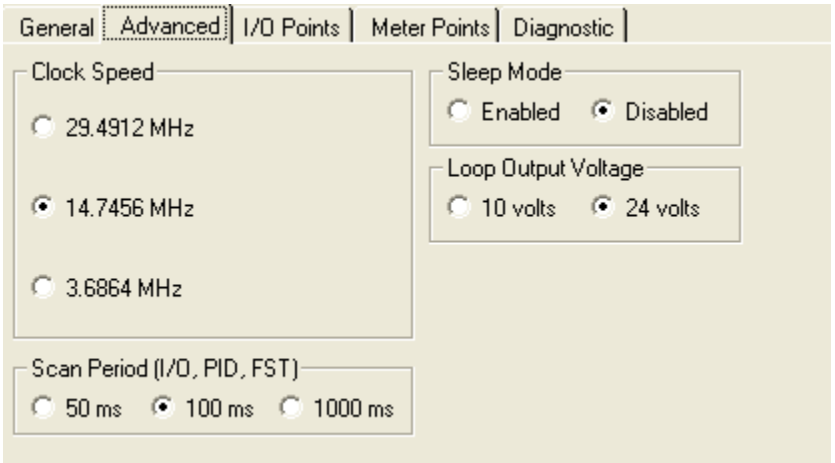
Pulse Input (If Used)

Variable	Units	Scan Period	Conversion	
Flow	M3/min	1 s	100,000	

Port	Baud	Parity	Data	Stop Bits
LOI	19200	None	8	1
COM1 MMI - PDI	19200	None	8	1
DISPLAY Proface	19200 or 57,600	None	8	1
OPTION CARD Modbus port	19200	None	8	1
COM 2 Printer	9600	None	8	1

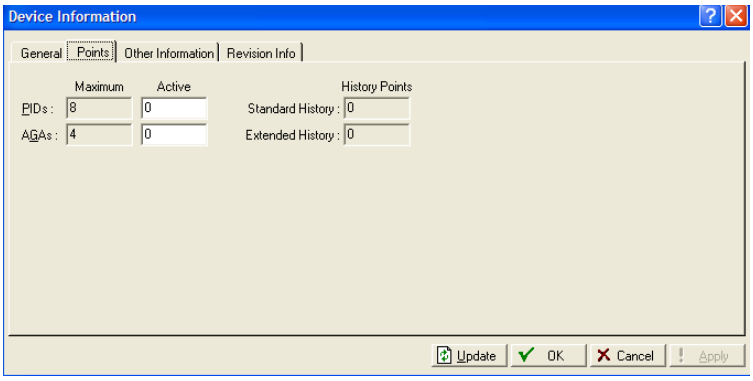
NOTE: Set Display Port Owner for ROC/Modbus Slave

CPU CARD SETTINGS:

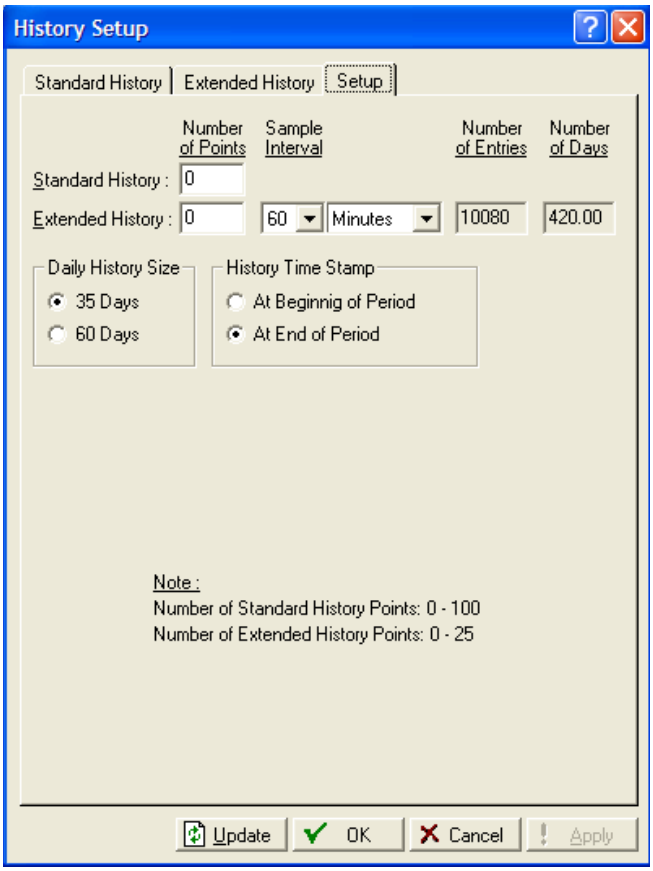


PID & AGA:

Disable all PIDs under the Control tab.



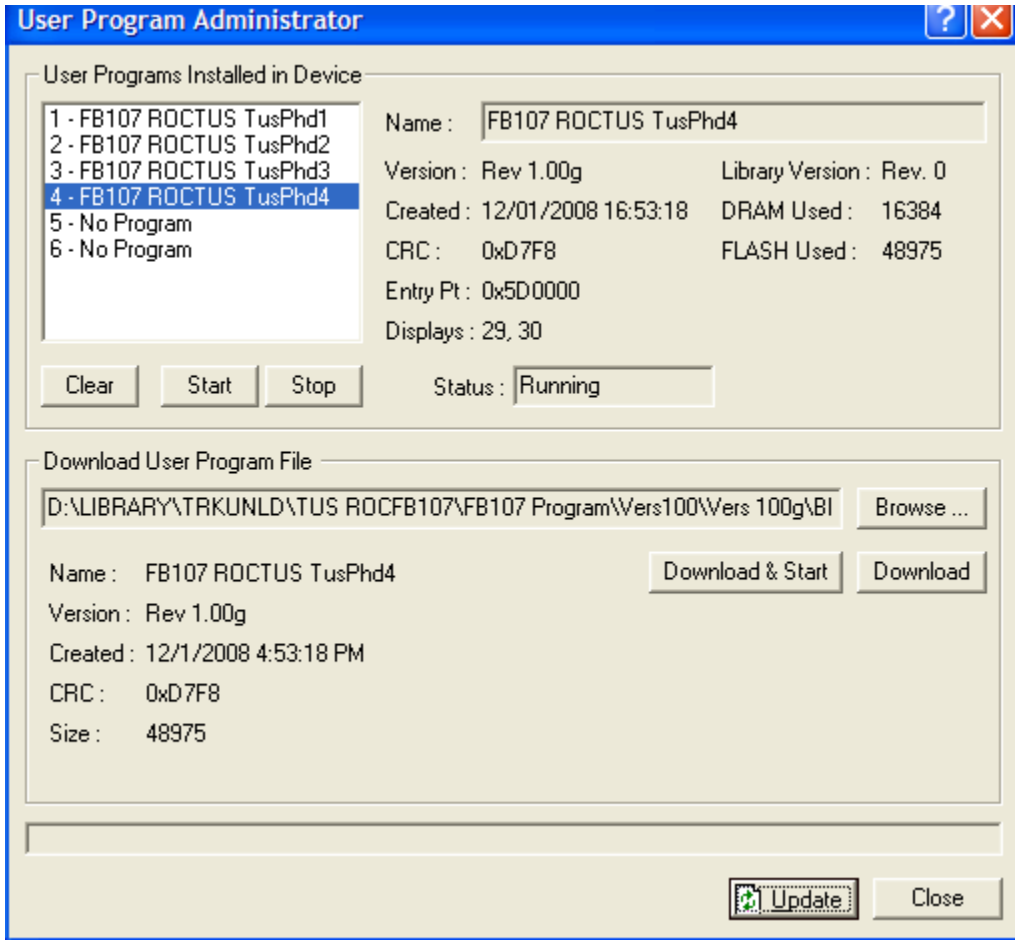
Disable History Points



Loading Software:

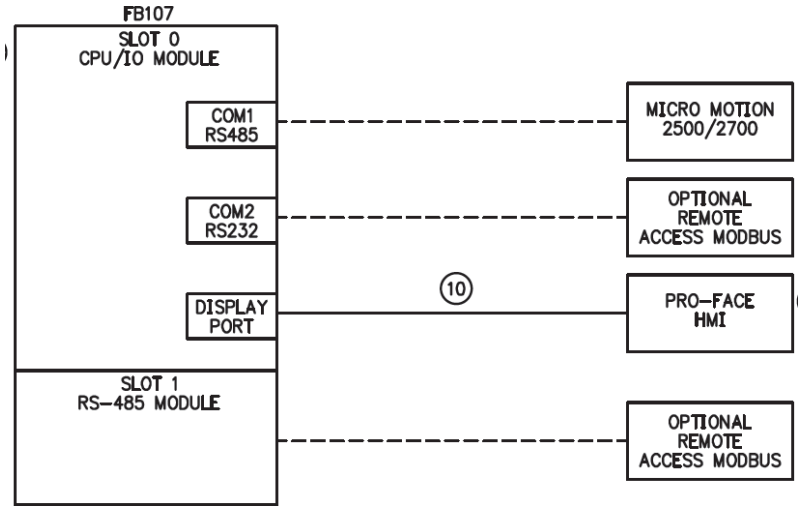
There are 5 programs to download in the FB107. Load software into the ROC by the following steps:

1) Clear All existing user programs
2) Choose and download & start user programs
3) Make sure both programs are Status ON
4) Initialize the database in the ROC through the Pro-Face configuration



COM Ports:

There are 5 COM ports used on the FB107 for truck unloading.
LOI Port – Used for ROCLINK and TUSWIN
COM 1 485 Port – Micro Motion COM 2 – Printer
485 Port Optional (Slot 2) – Modbus Com to host system Display Port – Pro-Face display interface
NOTE: Set Display Port Owner for ROC/Modbus Slave



5.2 Configuration of Micro Motion

Note: Even when communicating by modbus units configuration is required.

Volume Flow	**M3/min**
Mass Flow	Kg/min
Density	g/cc
Temperature	C

Analog Outputs

Variable	Units	Range	Dampening	Slug Flow Low	Low Cut Off
Density	g/cc	0 to 1.6	0.8 s	0.1g/cc below min density	0
Temp	Deg C	-20 to 140	2.4 s	NA	NA

Pulse Output

Variable	Units	Scaling		
Volume Flow	M3/min	100,000 P/M3		

Com Ports

Baud	Parity	Data	Stop Bits	
19,200	None	8	1	

5.3 Configuration of Proface

The Proface display has a configuration file that is loaded with the Proface software utility. The configuration software is called GP-Pro EX. The configuration file is provided by Spartan Controls.

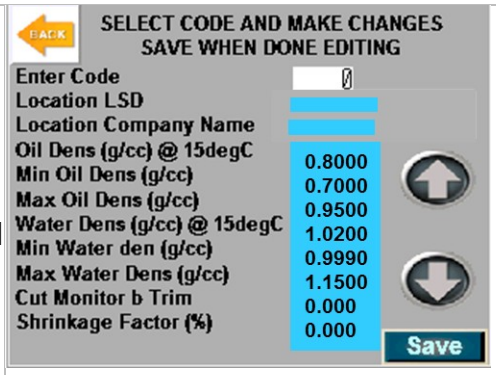
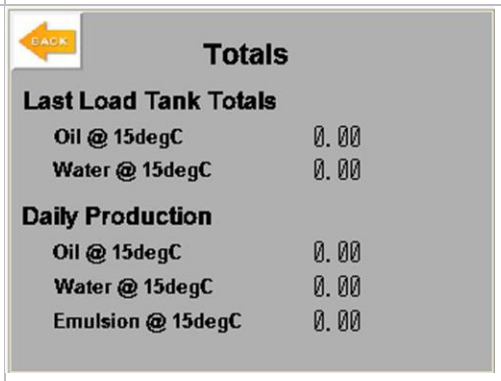
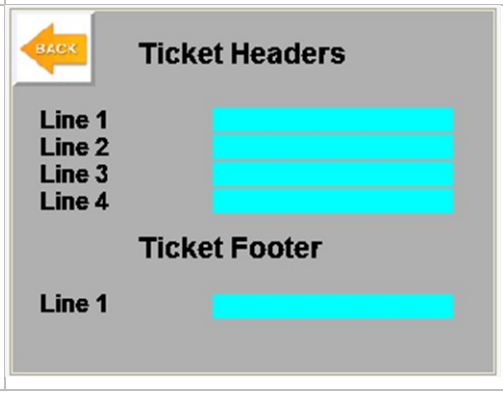
5.4 TUS Software Configuration Using Proface Unit

Configuration Menu

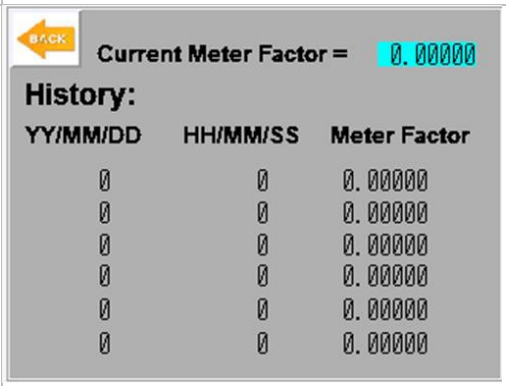
Operator Menu

LOGIN: The CONFIGURATION MENU allows configuration of common options in the system. To access the OPERATOR MENU touch the Spartan Controls logo in the top right corner of the display. This will bring up 3 optional screens to choose from.	
LOGIN: The 3 screen choices allow for maintenance (configuration changes), reprinting of tickets or alarm menu. Select the left hand maintenance icon.	
OPERATOR MENU: Select the OPERATOR MENU button. You will see a keyboard menu appear asking for a password. Password is 1000.	

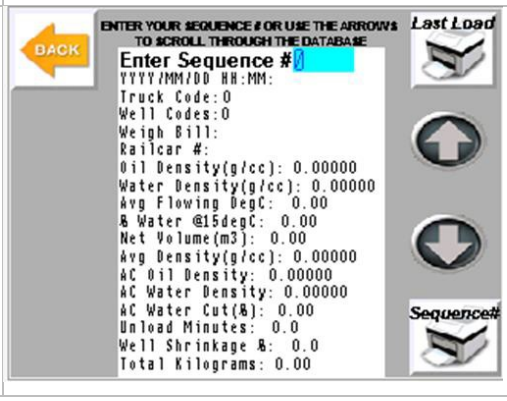
OPERATOR MENU: The OPERATOR MENU allows the user to add or edit TRUCKING COMPANIES or WELL LOCATIONS. You can also make basic CONFIGURATION changes, view TOTALS and edit TICKET HEADERS.	
TRUCKING COMPANIES: Selecting TRUCKING COMPANIES allows access to add, edit or print a list of companies.	
TRUCKING COMPANIES: To add a new trucking company use the up arrow to an open truck code # then enter the truck company name the SAVE.	
WELL LOCATIONS: Selecting WELL LOCATIONS allows access to add, edit or print a list of locations.	

WELL LOCATIONS: To add a new well location use the up arrow to access an open well code #. Edit the fields as required then SAVE. Typical well configuration is illustrated. If you expect to have free water or wet oil (>5%) the oil & water densities in the database should be maintained. Consult Spartan Controls for details.	
CONFIGURATION: Selecting CONFIGURATION allows some operational configuration settings. Consult Spartan Controls before making any changes as they will affect system operation.	
TOTALS: Selecting TOTALS allows viewing of the last load totals and daily production numbers.	
TICKET HEADERS: Selecting TICKET HEADERS allows editing of 5 lines of custom ticket messages.	

Proving Screen

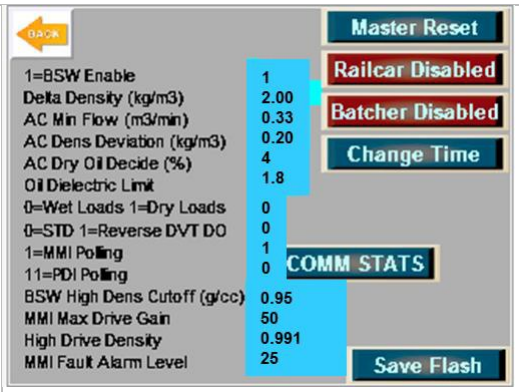
LOGIN: The CONFIGURATION MENU allows configuration of common options in the system. To access the PROVER MENU touch the Spartan Controls logo in the top right corner of the display. This will bring up 3 optional screens to choose from.	
LOGIN: The 3 screen choices allow for maintenance (configuration changes), reprinting of tickets or alarm menu. Select the left hand maintenance icon.	
PROVER MENU: Select the PROVER MENU button. You will see a keyboard menu appear asking for a password. Password is 222.	
PROVER MENU: The PROVER MENU allows the user to enter the most recent meter factor. The system will maintain the last 12 meter proves in history. The meter factor should always be between 0.9975 and 1.0025 in most cases.	

Historical Tickets

LOGIN: The CONFIGURATION MENU allows configuration of common options in the system. To access the HISTORY MENU touch the Spartan Controls logo in the top right corner of the display. This will bring up 3 optional screens to choose from.	
LOGIN: The 3 screen choices allow for maintenance (configuration changes), reprinting of tickets or alarm menu. Select the left hand maintenance icon.	
HISTORY MENU: Select the HISTORY MENU button. You will see a keyboard menu appear asking for a password. No Password is Required.	
HISTORY MENU: The history display past unloading tickets. You can use the up/down arrows to view tickets or enter a specific sequence number. Any ticket in history can be reprinted. NOTE: The system also maintains long term ticket and load data in a flash drive.	

Advanced Menu

LOGIN: The CONFIGURATION MENU allows configuration of common options in the system. To access the ADVANCED MENU touch the Spartan Controls logo in the top right corner of the display. This will bring up 3 optional screens to choose from.	
LOGIN: The 3 screen choices allow for maintenance (configuration changes), reprinting of tickets or alarm menu. Select the left hand maintenance icon.	
ADVANCED MENU: Select the OPERATOR MENU button. You will see a keyboard menu appear asking for a password. Password is 4685463.	

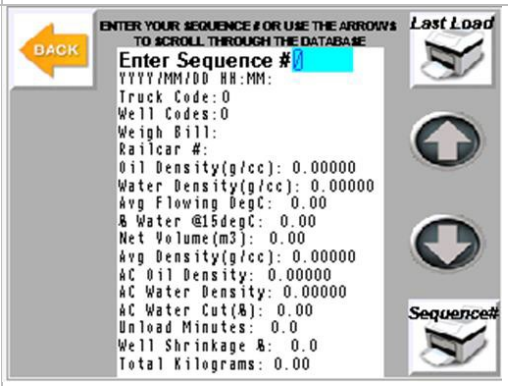
ADVANCED MENU: The advanced menu contains options that should only be made at start up or during service. No changes should be made in this menu under normal operation.	

Alarm Menu

LOGIN: The CONFIGURATION MENU allows configuration of common options in the system. To access the ALARM MENU touch the Spartan Controls logo in the top right corner of the display. This will bring up 3 optional screens to choose from.	
LOGIN: The 3 screen choices allow for maintenance (configuration changes), reprinting of tickets or alarm menu. Select the right hand alarm icon.	

ALARM MENU: The alarm menu allows for viewing of system alarms. The alarm monitoring can also be enabled or disabled.	

Reprinting Tickets

LOGIN: The CONFIGURATION MENU allows configuration of common options in the system. To access the TICKET MENU touch the Spartan Controls logo in the top right corner of the display. This will bring up 3 optional screens to choose from.	
LOGIN: The 3 screen choices allow for maintenance (configuration changes), reprinting of tickets or alarm menu. Select the middle ticket icon.	
PRINT TICKET MENU: The historical tickets are displayed. You can use the up/down arrows to view tickets or enter a specific sequence number. Any ticket in history can be reprinted.	

5.5 TUS Software Configuration Using TUSPHD Software

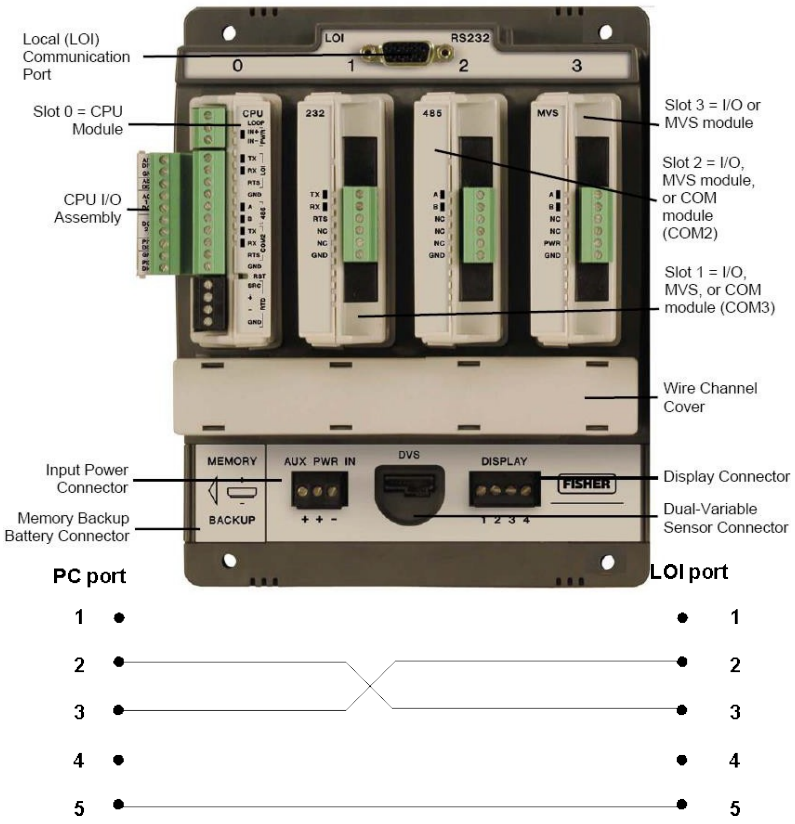
INSTALLATION

MANUAL INSTALLATION (will work on XP or any PC having an existing VB6.0 application previously installed)

1. Create a folder (TUSPHD) C:\TusWin
2. Copy the files provided by Spartan Controls into the folder:
3. If you have a previous version installed back up the files in the data directory then delete to entire data directory. Overwrite the existing files in directory with the updated files.
4. Run ROCTUSPHD.exe and a sub folder named C:\TusPHD\Data will be created. In the data directory will contain the configuration and history files for the system.

CONNECTING TO HARDWARE

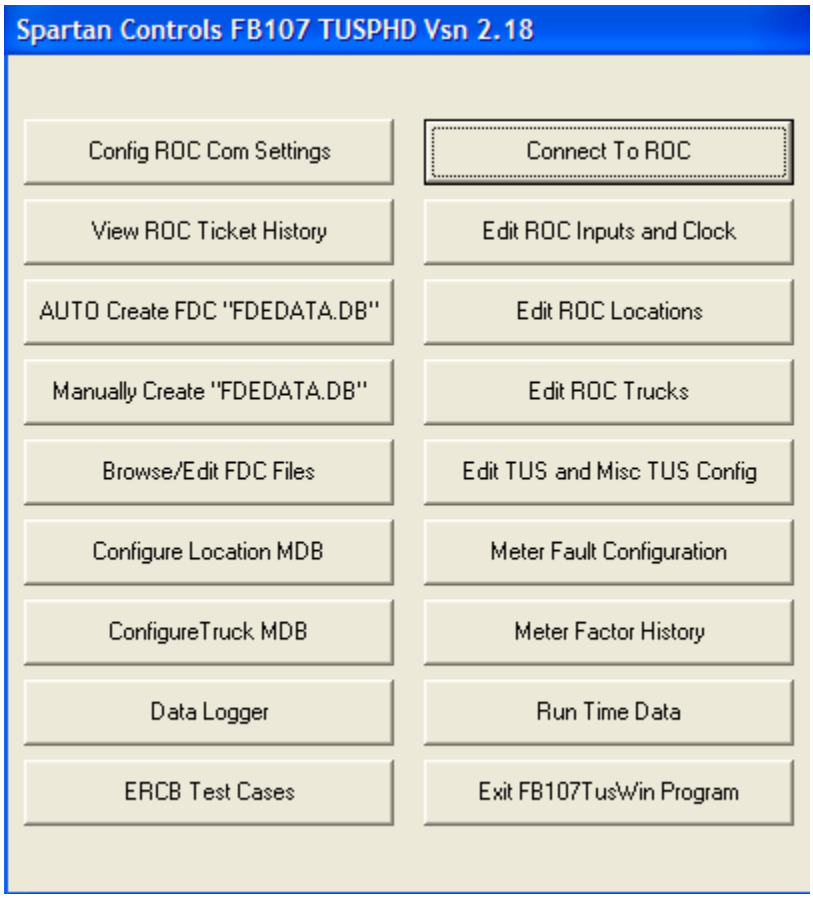
Communications are established between your PC serial port and the ROC LOI serial port. The LOI port must be wired into the CPU card or direct connection to the CPU card is required.



OPERATION

IMPORTANT:
The program has a single location and truck database. When you upload you will over write the database file on your PC. When you download you will over write the database in the ROC. It is strongly recommended that you regularly back up your data base files to another location on your PC for future access. Your database records are located in the ROCTUS.MDB file of the TUSPHD data directory.

The TUSPHD software can be used for configuration changes, database management and trouble shooting. When starting the program you will have the screen illustrated below.



A brief out line of the menus are listed in the following table:

Config ROC Com settings Allows for communication changes to ROC	Connect To ROC Start communications to ROC for data transfer
View ROC Ticket History Upload and viewing of truck tickets	Edit ROC inputs and Clock Confirms communication to ROC
Auto Create FDC FDEDATA.DB Configuration of FDC files for accounting program	Edit ROC Locations Viewing & editing of well database in FB107
Manual Create FDC FDEDATA.DB Configuration of FDC files for accounting program	Edit ROC Trucks Viewing & editing of truck database in FB107
Browse/Edit FDC Files Configuration of FDC files for accounting program	Edit TUS Configuration Main system configuration screen
Configure Location MDB Configuration of well database in PC database	Meter Fault Configuration Allow configuration of fault configuration settings
Configure Truck MDB Configuration of truck database in PC database	Meter Factor History Historical records of meter proves
Data Logger Upload up to 8 truck unload datalogs	Run Time Data View data while truck is unloading
ERCB Test Cases Allows verification of volume calculations	Exit Exit Program

Config ROC Com Settings:
This screen allows communication changes in your ROC. Leave settings as default.

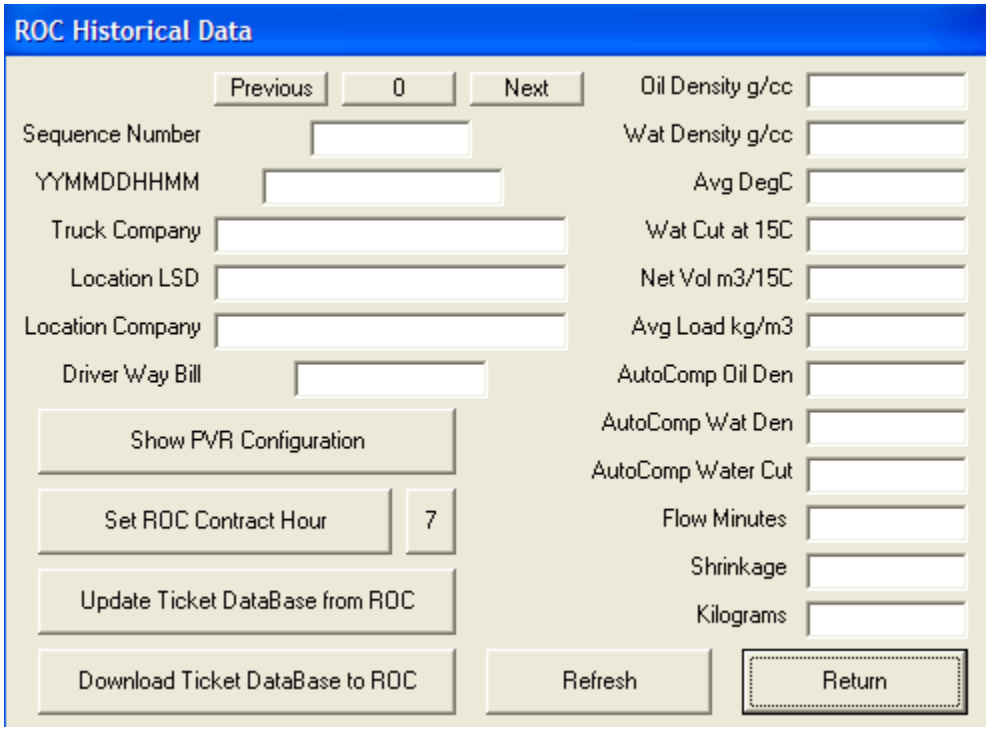
Connect To ROC
Change PC Com Settings:
This screen allows communication changes in your PC. This will be set up at startup and should not be changed under normal operation. Most common setting is COM 1 19200, n, 8, 1

View Ticket History

Allows viewing and uploading of historical tickets in ROC. You can also set a contract hour for your accounting records.

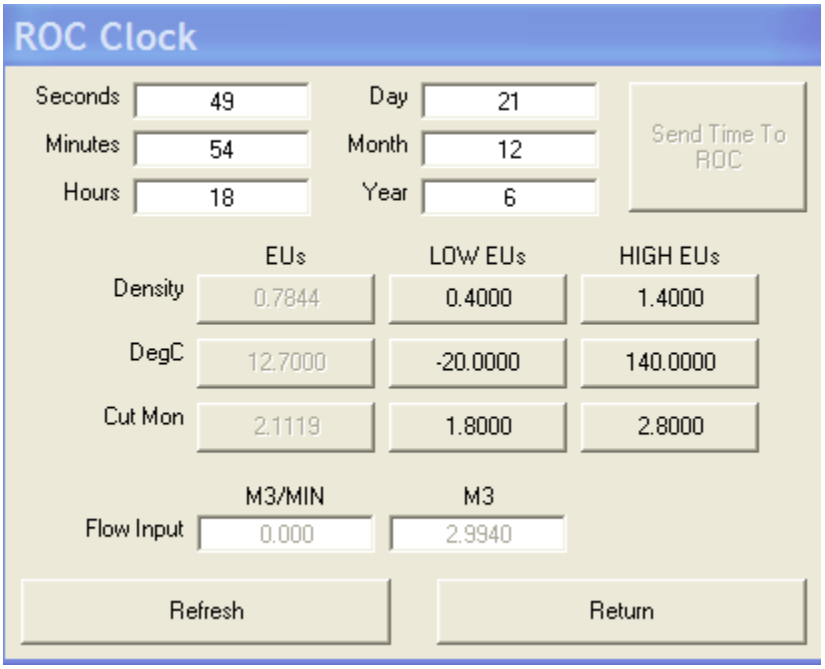
IMPORTANT:

The program has a single location and truck database. When you upload you will overwrite the database file on your PC.



ROC Clock

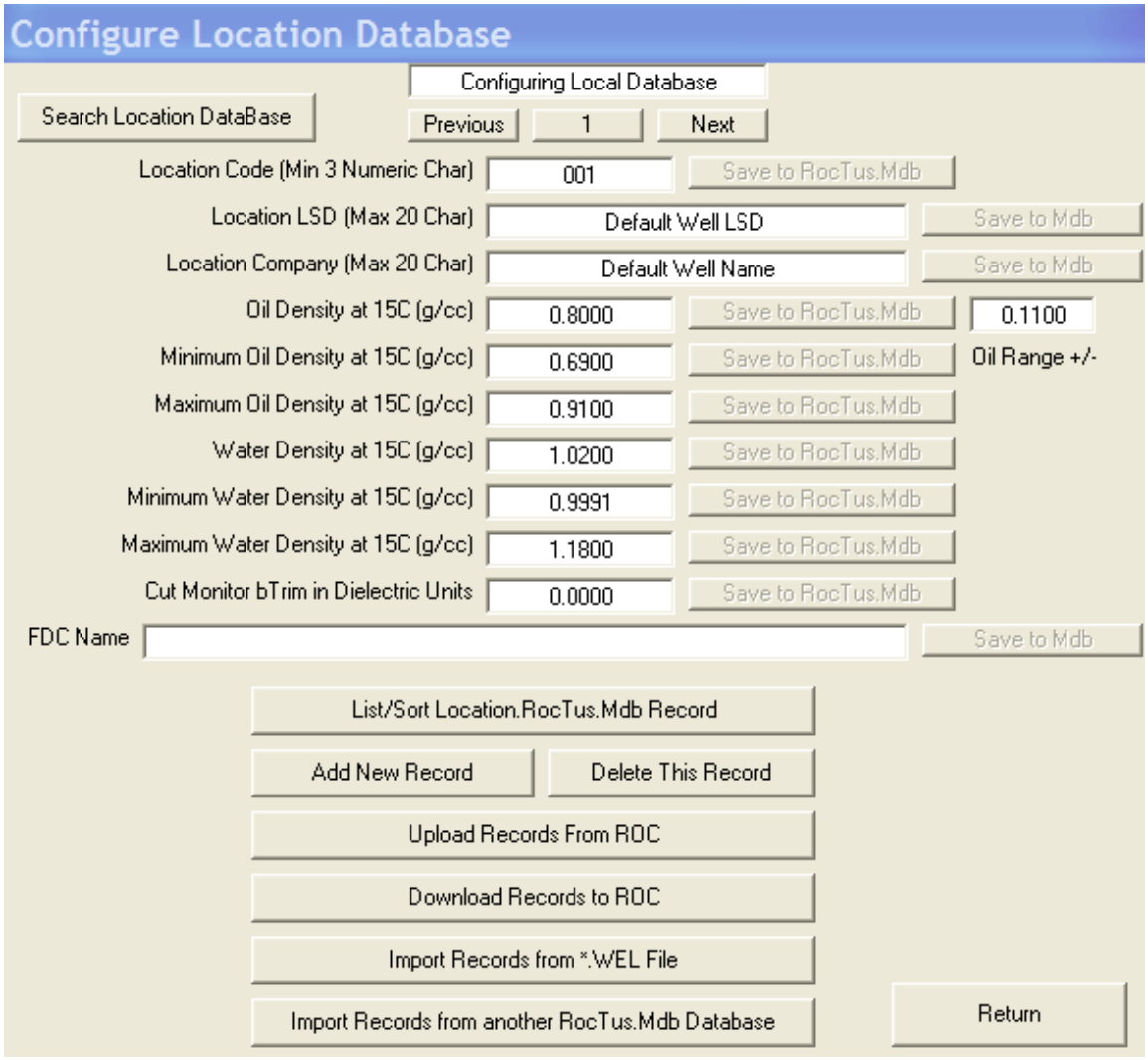
Allows viewing of ROC Clock to verify communications to ROC.



Configure Locations:

This screen allows the editing and new location entry. The location entry requires the information illustrated below. Most of the entries are self-explanatory. The minimum and maximum oil densities are the expected limits of density you expect for this location for use when the AutoComp software is enabled. The same entry is required for water densities.

NOTE: The Oil Range +/- will automatically update the minimum and maximum oil densities. It is recommended to keep this limit to less than 0.10 value.

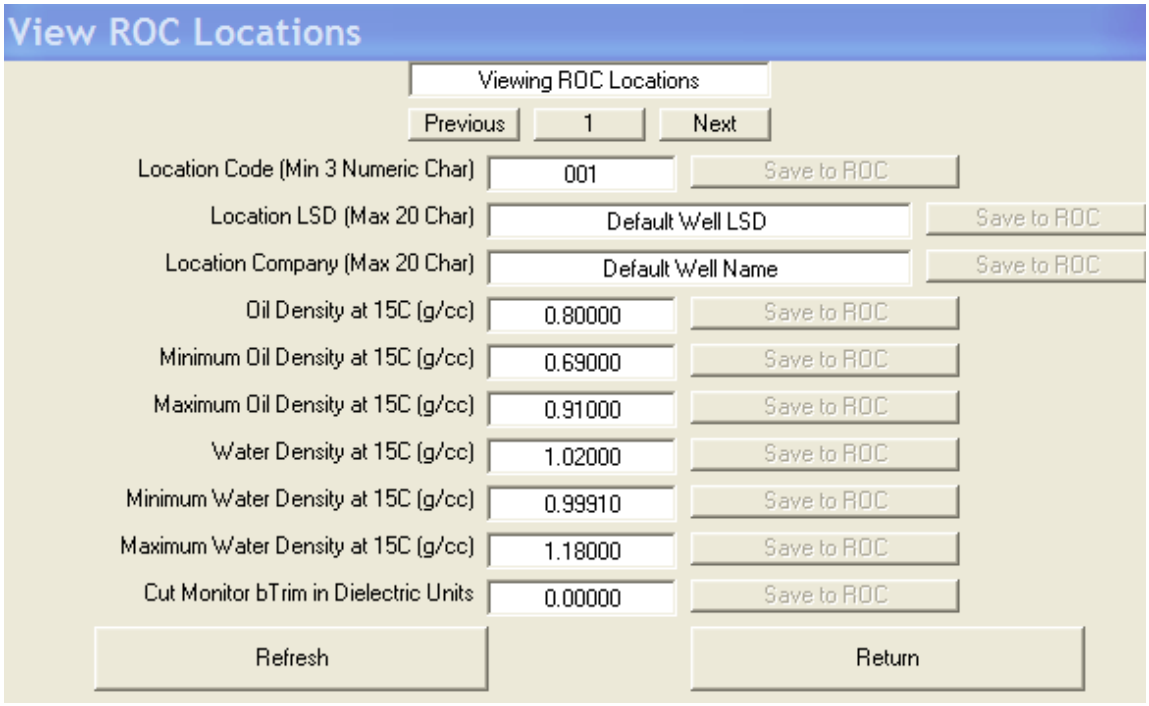


IMPORTANT:

The program has a single location and truck database. When you upload you will over write the database file on your PC. When you download you will over write the database in the ROC. It is strongly recommended that you regularly back up your data base files to another location on your PC for future access. Your database records are located in the ROCTUS.MDB file of the TUSPHD data directory.

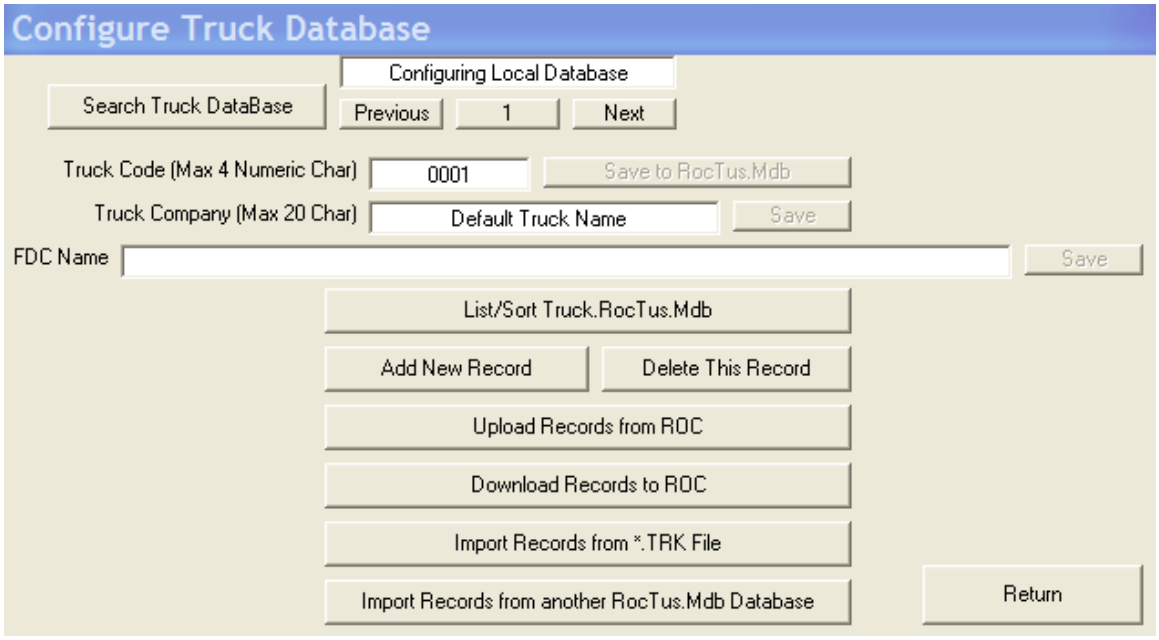
Edit ROC Locations

Allows viewing and editing of well locations in FB107.



Configure Trucks

This screen allows the entry of up to 100 trucks. The truck entry requires the information illustrated below. You require a 1 to 4-digit code along with a truck company name.

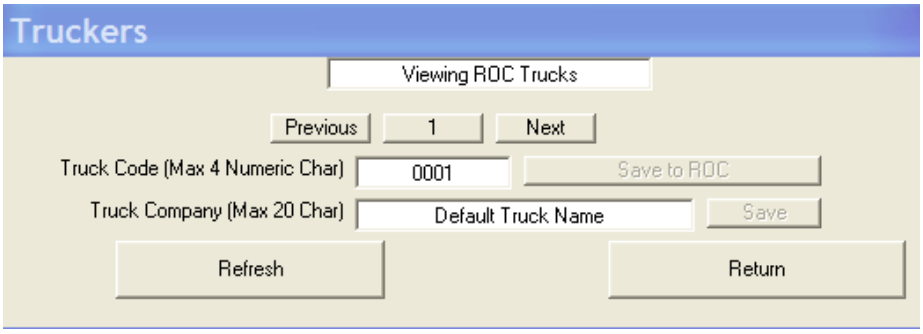


IMPORTANT:

The program has a single location and truck database. When you upload you will over write the database file on your PC. When you download you will over write the database in the ROC. It is strongly recommended that you regularly back up your data base files to another location on your PC for future access. Your database records are located in the ROCTUS.MDB file of the TUSPHD data directory.

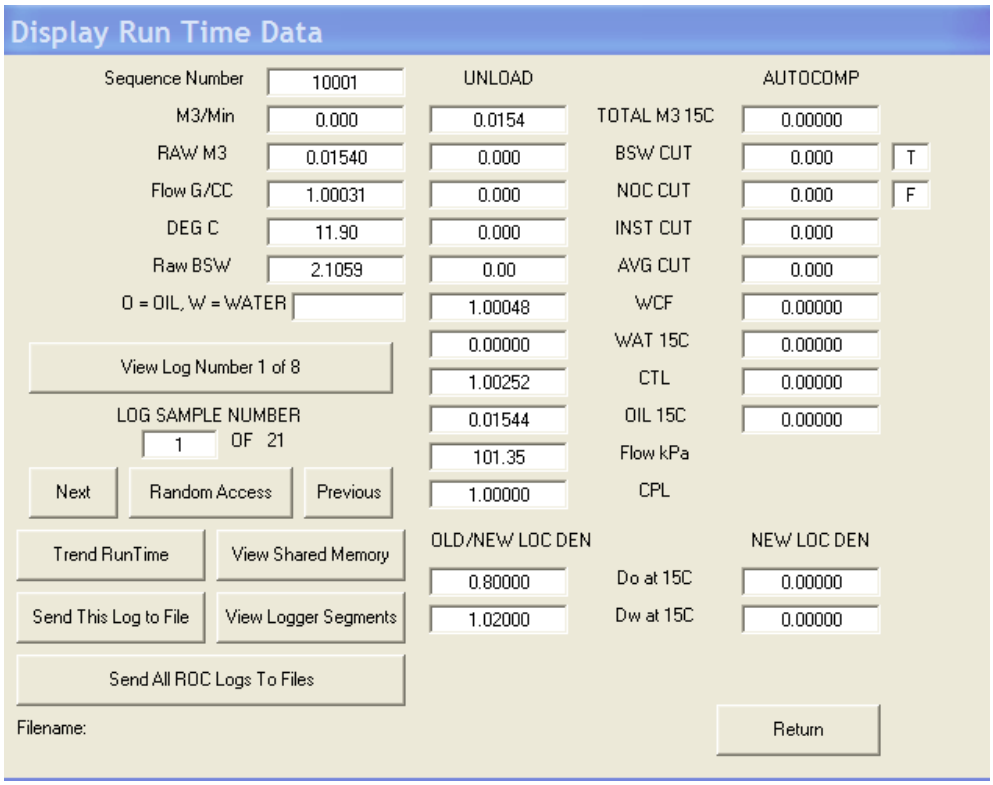
View ROC Trucks

This screen allows viewing and editing of the trucks in the FB107.



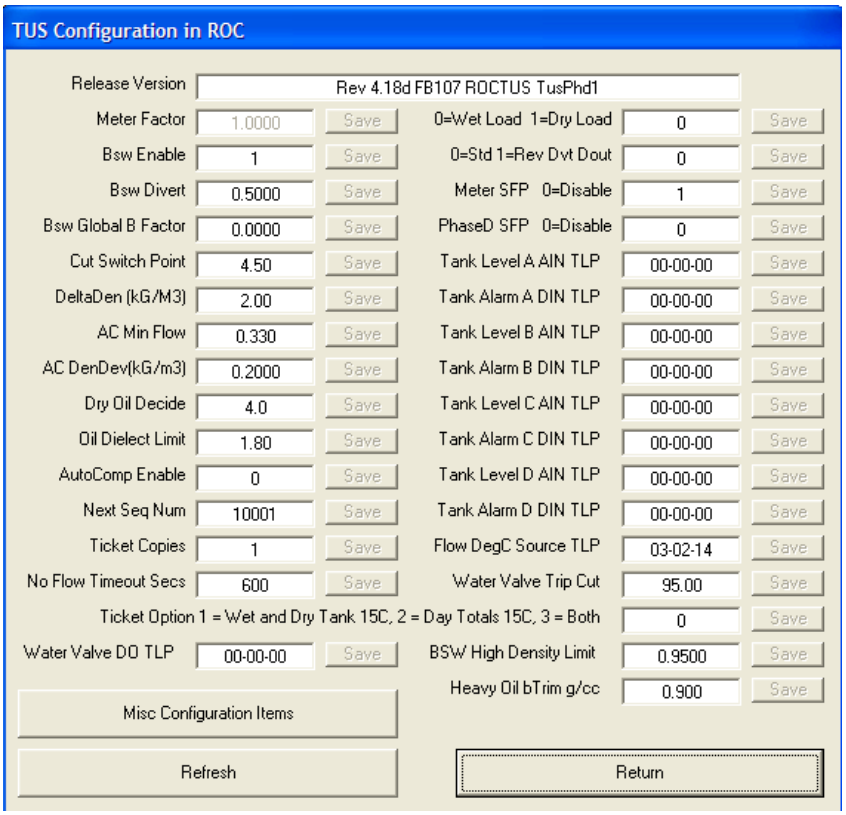
Data Logger

This screen allows you to enable data logging of consecutive unload records. The PC has to remain communicating to the ROC for this option as the records will be saved to your hard drive.



View TUS Configuration:

This is the main configuration screen for the system operation. The configuration can also be made using the front keypad per section 5.3 of this manual. The configuration of this screen will likely not change after initial commissioning and startup. The definition of each setting is explained in more detail in section 5.3 of this manual.

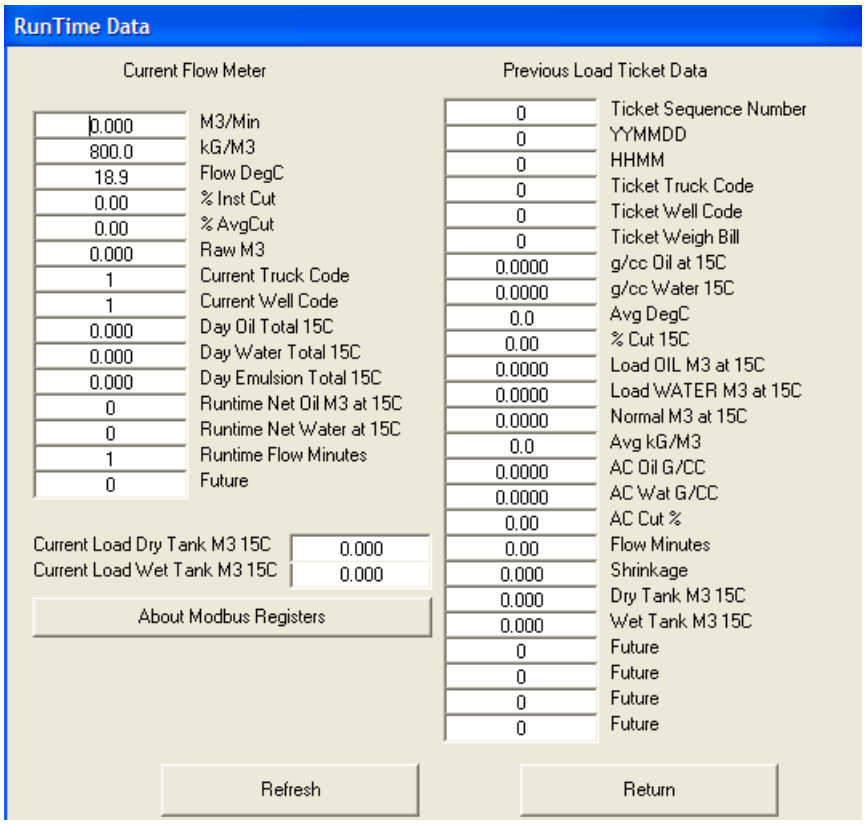


Release Date	Software version
Meter Factor	Meter factor entry after proving
BSW Enable	Cut Monitor installed? 0 = No 1 = Yes
BSW Divert	Divert water cut for 3-way divert valve See Note A
BSW Global B	Low water cut calibration offset for all wells < 5% water cut only (a change of 10 is approximately 1% water cut)
Cut Switch Point	Point where calculation switches from cut monitor to Micro Motion density (default 4.5)
Delta Density	Minimum flow for AutoComp calculation
Autocomp Min. Flow	Density tolerance decide for AC
AC Dens Dev	Water cut limit to accept AutoComp oil calc
Dry Oil Decide	Water cut limi to accept AutoComp oil calc
Oil Dielectric Limit	Low limit dielectric for AutoComp calc
AutoComp Enable	AutoComp = 0 off, 1 code, 2 automatic
Next Sequence Number	Load tracking counter
Ticket Copies	Printed ticket quantity
NoFlow TO	Load will terminate if no flow is present past setting
O = Wet 1 = Dry	Wet/dry oil logic
O = Std 1 = Rev	DOUT Discrete Out Logic setting
Heavy Oil b Trim Density	Calculation offset for heavy oil BSW

Note A*: When the oil goes from wet to dry there is a delay count of approximately 50 seconds before the valve switches.*
When the oil goes from dry to wet there is a delay count of approximately 5 Seconds.

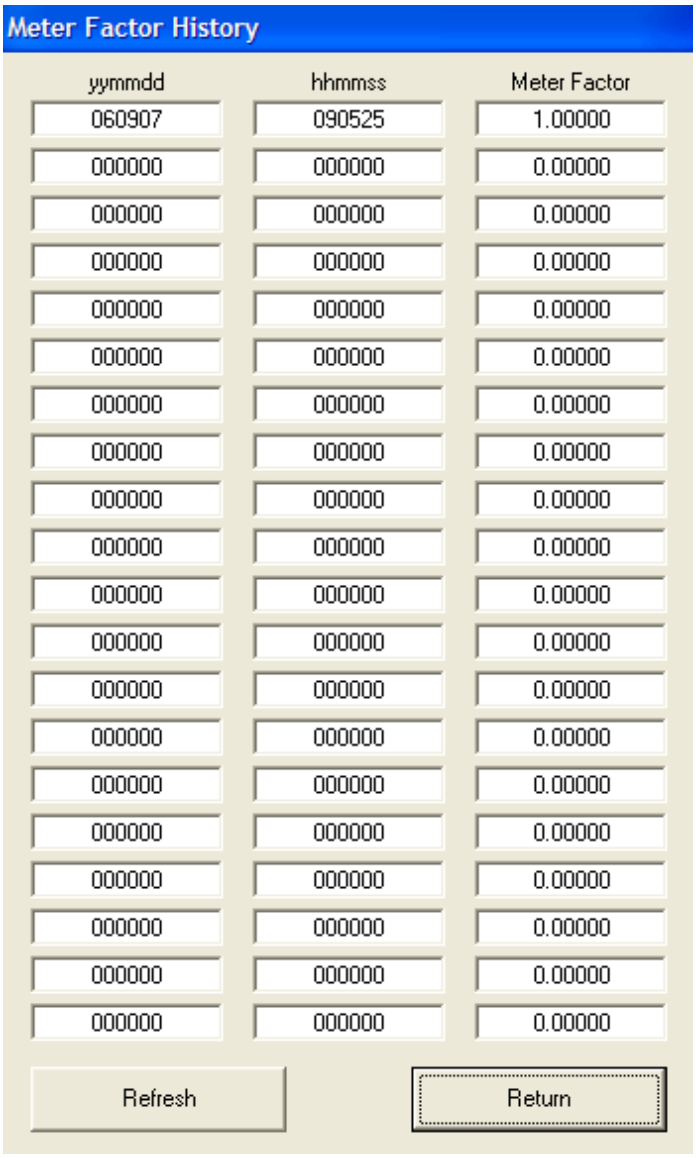
Run Time Data

Allows viewing of data during unloading process.



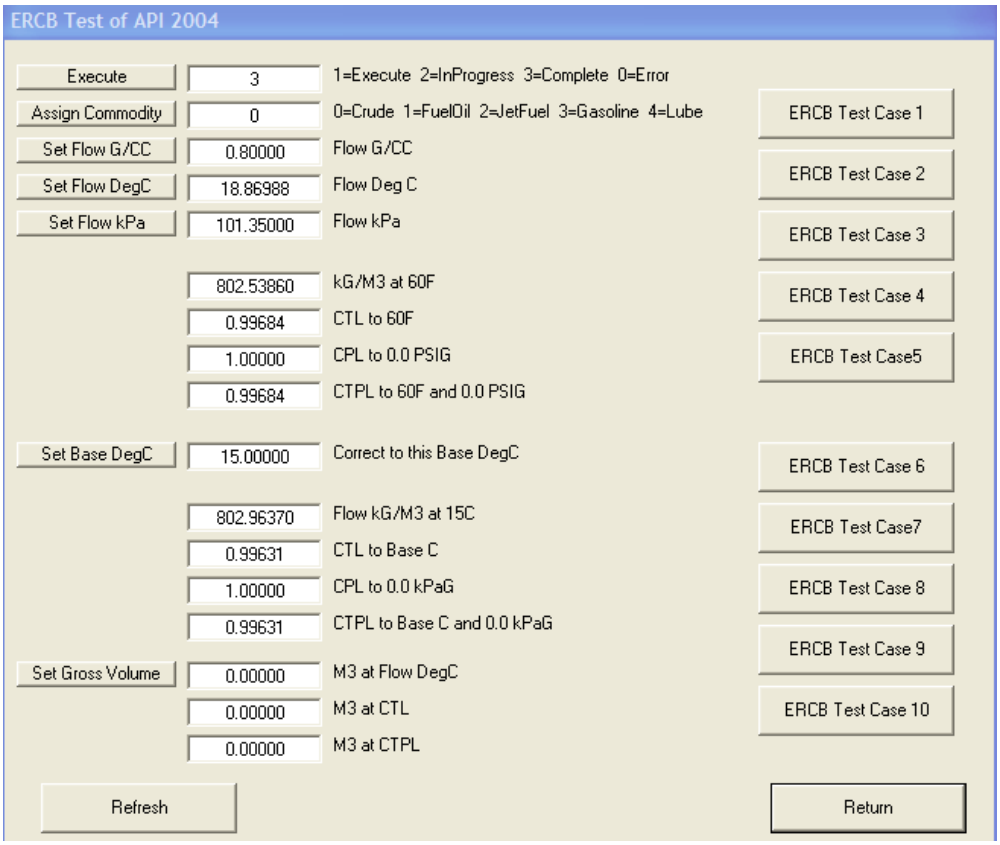
Meter Factor History

Historical records for up to 20 meter factors are maintained by the system.



ERCB Test Cases

The ERCB test case menu allows you to test the calculations being performed by the FB107 system. The calculation tested in the API 2540 2004 calculation during dry oil conditions (when water cut is less than configured cut switch point). By selecting the ERCB test case 1-10 an excel file is created in the data directory showing the results of the test as dictated in Directive 17.



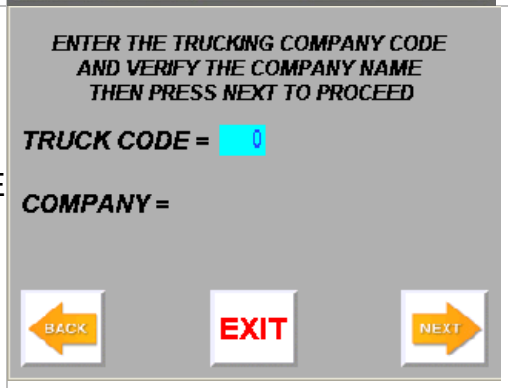
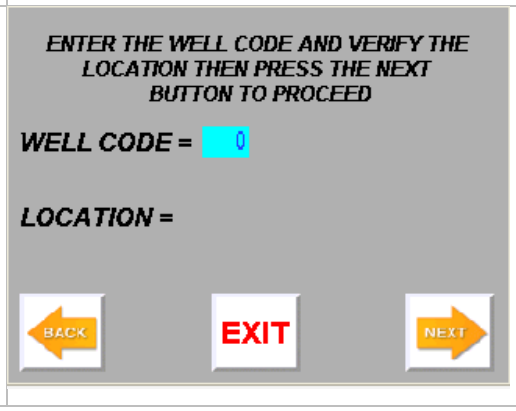
5.6 TUS Software Configuration Using ROCLINK800

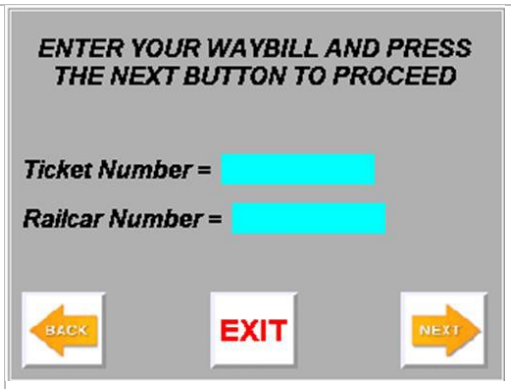
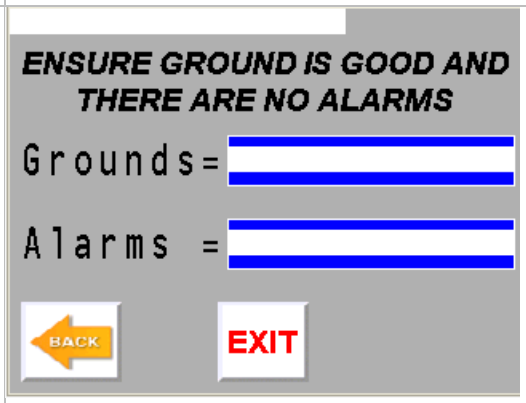
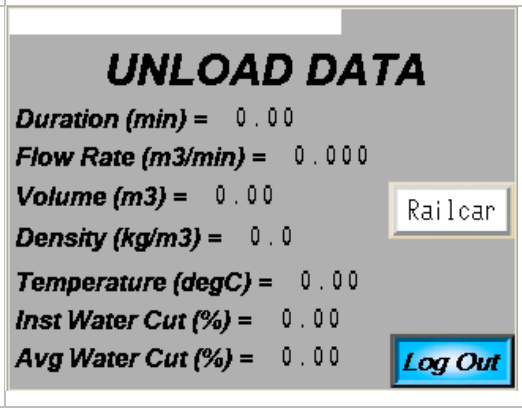
System configuration can be done by ROCLINK800 software however the tickets, truck and well database can only be viewed one field at a time. For viewing and editing of the system wells and trucks it is recommended using TUSPHD software.

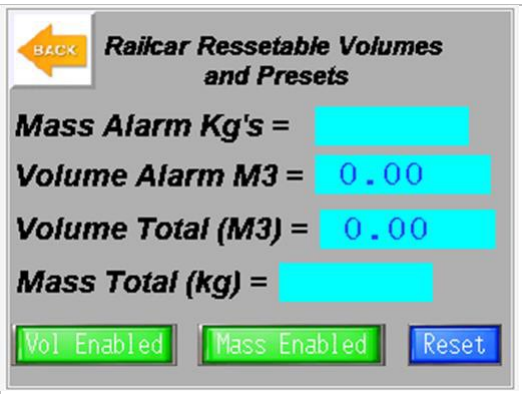
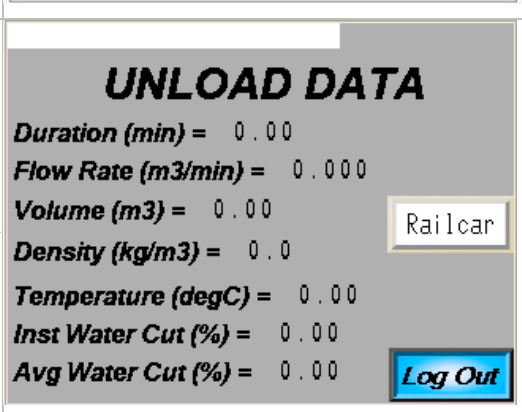
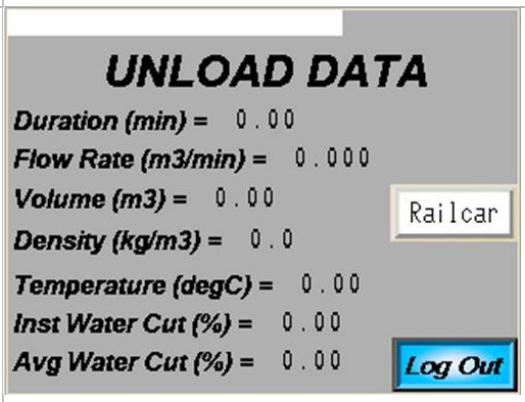
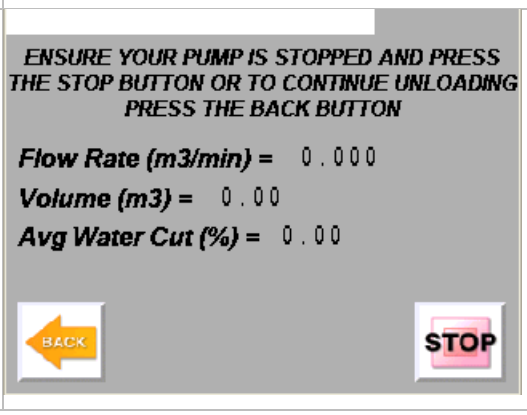
6.0 Operation

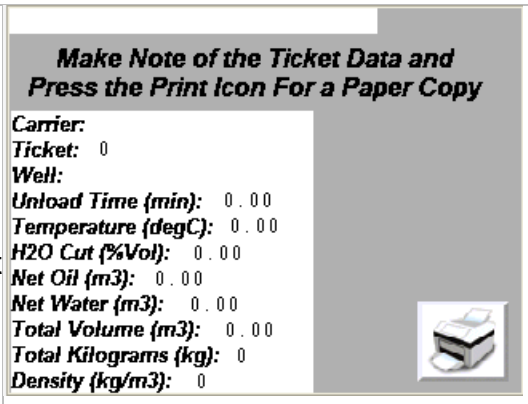
6.1 Operating the Truck Unload Panel

The following provides the truck unloading instruction for the Transloader and Truck Unloading system software.

LOGIN: There are 2 selections at LOGIN. If you select the RAILCAR button you can enter is a batch mass & volume for the rail car. If the mass or volume is reached an alarm will be posted on the bottom of the display. To initiate the unloading process touch the “LOGIN” button.	
TRUCK CODE: Enter the TRUCK CODE from a predefined numerical list.	
WELL CODE: Enter the WELL CODE from a predefined numerical list.	

TICKET NUMBER: Enter the truck ticket number and rail car ID number.	
VERIFY DATA: This screen shows the selections made. If everything is correct touch the NEXT key. If a correction is required touch the BACK key.	
GROUNDING & ALARMS: The alarms or ground status is displayed on this screen. If there are any alarms or the truck is not grounded you will not be able to proceed. If there are no alarms the screen will proceed to the UNLOAD DATA screen.	
UNLOAD DATA: The UNLOAD DATA screen displays the process data during the unload process. If you are monitoring the volume or mass for the rail car touch the RAILCAR key to access the totalized values for the rail car.	

RAIL CAR MASS & VOLUME: The RAILCAR screen allows the user to enter the maximum mass and volume for the rail car. After the entered target is reached an alarm indication will be displayed on the screen. You can disable the alarms on this screen if desired.	
UNLOAD DATA: Touching the BACK key will return you to the UNLOAD DATA screen.	
LOGOUT: When the truck unload is complete you touch the LOG OUT key.	
LOGOUT: The final volume and average water cut is displayed. This screen allows you to confirm to STOP unloading or go back to the UNLOAD DATA screen. If you are done touch the STOP key.	

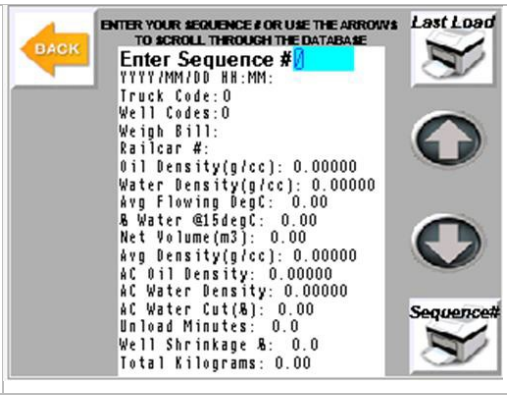
TICKET: The final ticket will be displayed. Touch the PRINTER key to print the ticket. After printing is complete the transaction will be completed and the screen will go back to LOGIN for the next unload.	
LOAD COMPLETION: After printing is complete the transaction will be completed and the screen will go back to LOGIN for the next unload.	

6.2 Not In Use

6.3 Historical Unload Data

LOGIN: The CONFIGURATION MENU allows configuration of common options in the system. To access the HISTORY MENU touch the Spartan Controls logo in the top right corner of the display. This will bring up 3 optional screens to choose from.	
LOGIN: The 3 screen choices allow for maintenance (configuration changes), reprinting of tickets or alarm menu. Select the left hand maintenance icon.	
HISTORY MENU: Select the HISTORY MENU button. You will see a keyboard menu appear asking for a password. No Password is Required.	

HISTORY MENU: The history display past unloading tickets. You can use the up/down arrows to view tickets or enter a specific sequence number. Any ticket in history can be reprinted.
NOTE: The system also maintains long term ticket and load data in a flash drive.



6.4 Meter Proving

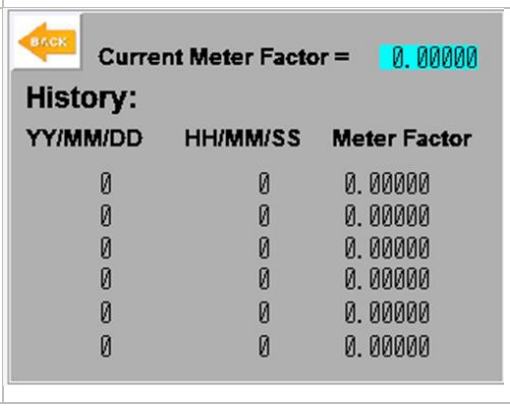
Volumetric Proving: This is the preferred method proving a Micro Motion coriolis meter. Use either a Ball Prover or Compact Piston Prover to insure you can prove the normal operating rate of the truck unloading. The transmitter should be configured to provide the prover with 100,000 pulses per 1 m3. The volume pulse from the Micro Motion is non corrected volume. The volume from the Micro Motion also does not account for any previous meter factor entered in the unloading panel. The new meter factor directly replaced the old meter factor in the system. The proving should be done at a constant flow rate close to the normal unloading rate at the facility. The prover will calculate a meter factor based on the formula:

Prover Volume / Micro Motion Volume

The meter factor can be entered into the system by the driver display, TUSPHD software or ROCLINK software. The following is the Proface display instructions:

Proving Screen

LOGIN: The CONFIGURATION MENU allows configuration of common options in the system. To access the PROVER MENU touch the Spartan Controls logo in the top right corner of the display. This will bring up 3 optional screens to choose from.

LOGIN: The 3 screen choices allow for maintenance (configuration changes), reprinting of tickets or alarm menu. Select the left hand maintenance icon.	
PROVER MENU: Select the PROVER MENU button. You will see a keyboard menu appear asking for a password. Password is 222.	
PROVER MENU: The PROVER MENU allows the user to enter the most recent meter factor. The system will maintain the last 12 meter proves in history. The meter factor should always be between 0.9975 and 1.0025 in most cases.	

7.0 Appendix

7.1 Modbus Access

FB107 ModBus Map as of Version 2.18 Date: April 2011
Default ModBus Soft Point 31 TusPhd Page 1 of 2

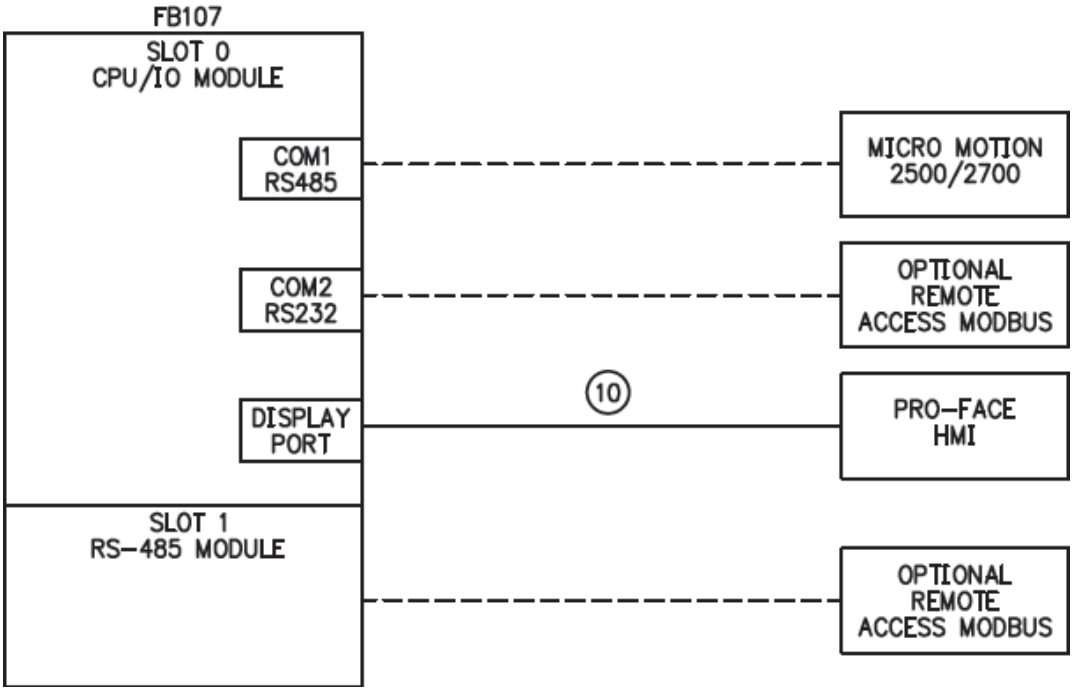
Start	End	Data	T	L	P	
0	1	1	17	30	2	Meter Flow Rate M3/Minute
2	3	2	17	30	3	Flow Density KG/M3
4	5	3	17	30	4	Flow °C
6	7	4	17	30	5	% Inst Water Cut
8	9	5	17	30	6	% Avg Water Cut
10	11	6	17	30	7	Load Accumulation M3 at Flow °C
12	13	7	17	30	8	Current Truck Code
14	15	8	17	30	9	Current Well Code
15	17	9	17	30	10	Day Oil Total M3 at 15°C
18	19	10	17	30	11	Day Water Total at 15°C
20	21	11	17	30	12	Day Emulsion Total at 15°C
22	23	12	17	30	13	Runtime Net Oil M3 at 15°C
24	25	13	17	30	14	Runtime Net Water M3 at 15°C
26	27	14	17	30	15	Runtime Flow Minutes
28	29	15	17	30	16	Future Runtime Variable
30	31	16	17	30	17	Ticket Sequence Number Displayed and Request SegNum Target
32	33	17	17	30	18	YYMMDD
34	35	18	17	30	19	HHMM
36	37	19	17	30	20	Ticket Truck Code
38	39	20	17	30	21	Ticket Well Code

Soft Point 32 TusPhd

		Data	T	L	P	
40	41	1	17	31	2	Ticket Weight Bill
42	43	2	17	31	3	g/cc Oil at 15°C for NOC
44	45	3	17	31	4	g/cc Water at 15°C for NOC
46	47	4	17	31	5	Flow Weighted Avg °C for Load
48	49	5	17	31	6	% Water Cut at 15°C
50	51	6	17	31	7	Load Oil M3 at 15°C
52	53	7	17	31	8	Load Water M3 at 15°C
54	55	8	17	31	9	Normal Load M3 15°C
56	57	9	17	31	10	Flow Weighted Avg kg/M3
58	59	10	17	31	11	Auto Comp Oil g/cc
60	61	11	17	31	12	Auto Comp Water g/cc
62	63	12	17	31	13	Auto Comp % Water Cut
64	65	13	17	31	14	Flow Minutes for Load
66	67	14	17	31	15	Shrinkage
68	69	15	17	31	16	Dry Tank M3 at 15°C
70	71	16	17	31	17	Wet Tank M3 at 15°C
72	73	17	17	31	18	Load Kilograms
74	75	18	17	31	19	Future Ticket Parameter
76	77	19	17	31	20	Future Ticket Parameter
78	79	20	17	31	21	Future Ticket Parameter

7.2 Communication Wiring

The communication wiring to the FB107 panel is illustrated below.



There is also an additional combination port (LOI port) not illustrated. The LOI port is used for configuration with the ROCLINK and TUSWIN program.

7.3 Water Cut Measurement

Spartan Controls Water Cut Offerings

The system water cut determination is typically provided in the following methods:

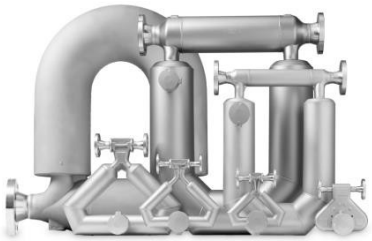
0-5% Density Compensated Drexelbrook Cut Monitor
0%-100% or 5%-100% Net Oil Density Comparison using Micro Motion
0%-100% Microwave water analysis using Phase Dynamics

Most systems incorporate the Density Compensated (Spartan U.S. Patent: 5,325,066, Canadian Patent # 2,074,017) 0-5% monitor and the Net Oil Density Comparison (U.S. patents# 4,689,989, 4,773,257) 5%-100% for the water cut calculation. The density compensated water cut monitor is used to improve WC resolution to pipeline spec over the 0-5% WC range. In heavy oil applications >930Kg/M3 it is beneficial to perform the 0- 100% WC calculation using a Phase Dynamics Microwave Analyzer. The Micro Wave analyzer does not require a minimum oil/water density span in the calculation

allowing it to provide significantly improved WC accuracy. In applications where minimal data base management is desired the Phase Dynamics can be used across density ranges from condensate to heavy oil. In these applications the Density Compensated (Spartan U.S. Patent: 5,325,066, Canadian Patent # 2,074,017) is implemented to fine tune the water cut measurements due to density effects.

MEASUREMENT HARDWARE

Micro Motion Coriolis Meter



- Custody transfer approved
- No maintenance required
- Measurements provided:
  - Volume
  - Density
  - Temperature
- Provides measurement for 0-100% water cut
- Calculation in conventional oil applications.

Drexelbrook Water Monitor

- Digital calibration
- No maintenance
- Probe design
- Provides measurement for high resolution 0-5%
- water cut calculation in conventional oil applications.
- When combined with a Coriolis Meter the water cut ranges are:
- Drexelbrook 0-5% Water Cut
- Coriolist Meter 5-100% Water Cut

Phase Dynamics Water Analyzer

- Digital calibration
- No maintenance design
- Provides meaurement for 0-100% water cut
- Calucation in heavy oil applications.

7.4 Not in Use

7.5 Autocomp Software

Water Cut Background

Most Truck Unloading applications implement water cut calculations based on oil & water density comparisons. The following illustrates the method.

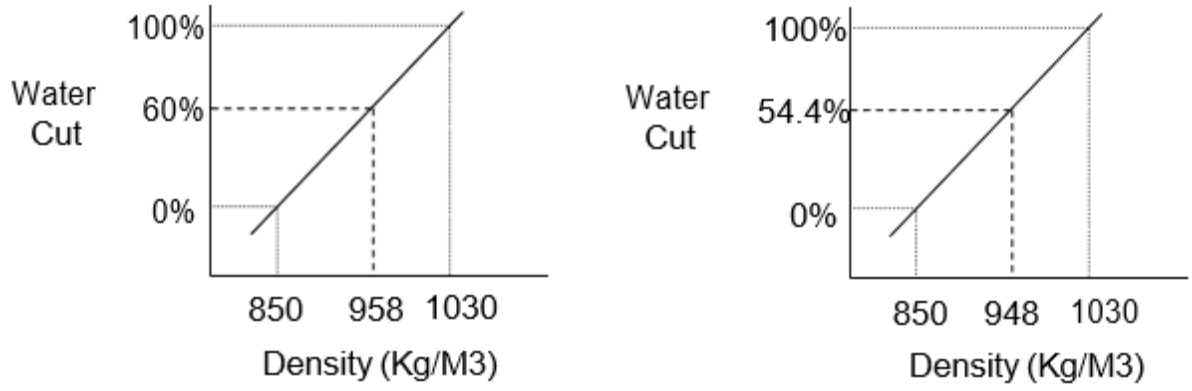
Density Inferred Water Cut (0-100%)

Water cut measurement in the range of 0% to 100% is achieved using the density signal from the Coriolis meter. The on line density signal is compared against dry oil and clean water densities that were previously programmed in the flow computer. Water cut measurement using density is achieved as follows:

$$X_w = \frac{\rho_m - \rho_o}{\rho_w - \rho_o}$$

ρm = Density Mixture (Measured)
ρw = Density Water (Entered)
ρo = Density Oil (Entered)
Xw = Water Cut Measured / Calculated

The calculated volume split of oil and water is temperature corrected to 15C. The following example illustrates the calculation.



This comparison results in a straight-line relationship to calculate percent water cut. Generally the maximum achievable water cut accuracy is +/-1%. Oil & water density spans less than 100Kg/M3 will result in decreased water cut accuracy.

The key to an accurate water cut measurement is maintaining accurate oil & water densities in the system database. The calculation is only as good as the data provided for the calculation to take place.

7.6 Reserved Soft Points

Soft Point 1 in the FB107 is used for Micro Motion variable coming in by modbus SP1

DATA 1 Mass Flow Rate
DATA 2 Density
DATA 3 Temperature
DATA 4 Volume Flow Rate
DATA 5 Viscosity
DATA 6 Pressure
DATA 7 Mass Total DATA 8Volume Total
DATA 9 Mass Inventory
DATA 10 Volume Inventory
DATA 11 Raw Tube Frequency
DATA 12 Left Pick Off
DATA 13 Right Pick Off
DATA 14 Drive Gain

Soft Point 11 in the FB107 is used for Phase Dynamics variables coming in by modbus SP 11

DATA 1: PDI CUT via Modbus
DATA 2: PDI Process Temperature via Modbus
DATA 3: PDI User Temperature via Modbus
DATA 4: PDI Emulsion Phase via Modbus
DATA 5: PDI Oil Adjust from TLP 22,0,63 User Configured
DATA 6: PDI Water Cut Offset TLP 22,0,64 User Configured
DATA 7: RawCut = PdiCut - PdiWCoffset
DATA 8: Density Used for Corrected Water Cut
DATA 9: Corrected Water Cut % not Zero Clipped
DATA10: Corrected Water Cut (%/100.0) and Zero Clipped.
DATA11: Flow Density g/cc
DATA12: VCF
DATA13: Location Oil Density g/cc
DATA14: PDI Slope via TLP 22,0,65 User Configured

SOFT POINT 31

DATA	T	L	P	
1	17	30	2	Meter Flow Rate M3/Minute
2	17	30	3	Flow Density kG/M3
3	17	30	4	Flow DegC
4	17	30	5	% Inst Water Cut
5	17	30	6	% Avg Water Cut
6	17	30	7	Load Accumulation M3 at Flow DegC
7	17	30	8	Current Truck Code
8	17	30	9	Current Well Code
9	17	30	10	Day Oil Total M3 at 15C
10	17	30	11	Day Water Total at 15C
11	17	30	12	Day Emulsion Total at 15C
12	17	30	13	Runtime Net Oil M3 at 15C
13	17	30	14	Runtime Net Water M3 at 15C
14	17	30	15	Runtime Flow Minutes
15	17	30	16	Future Runtime Variable
16	17	30	17	Ticket Sequence Number
17	17	30	18	YYMMDD
18	17	30	19	HHMM
19	17	30	20	Ticket Truck Code
20	17	30	21	Ticket Well Code

SOFT POINT 32

DATA	T	L	P	
1	17	31	2	Ticket Weigh Bill
2	17	31	3	g/cc Oil at 15C for NOC
3	17	31	4	g/cc Water at 15C for NOC
4	17	31	5	Flow Weighted Avg DegC for Load
5	17	31	6	% Water Cut at 15C
6	17	31	7	Load Oil M3 at 15C
7	17	31	8	Load Water M3 at 15C
8	17	31	9	Normal Load M3 at 15C
9	17	31	10	Flow Weighted Avg kG/M3
10	17	31	11	Auto Comp Oil g/cc
11	17	31	12	Auto Comp Water g/cc
12	17	31	13	Auto Comp % water Cut
13	17	31	14	Flow Minutes for Load
14	17	31	15	Shrinkage

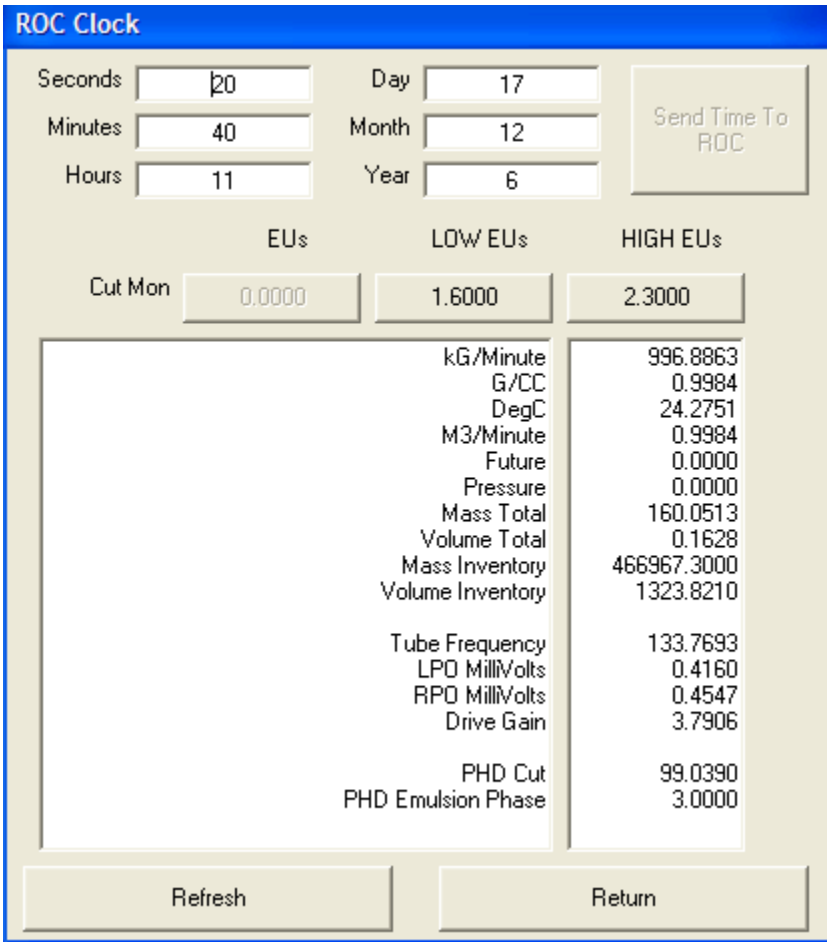
15	17	31	16	Dry Tank M3 at 15C
16	17	31	17	Wet Tank M3 at 15C
17	17	31	18	Load KiloGrams
18	17	31	19	Future Ticket Parameter
19	17	31	20	Future Ticket Parameter
20	17	31	21	Future Ticket Parameter

7.7 TROUBLESHOOTING

This section is useful for solving some common problems that may occur. If the information does not solve the problem, call Spartan Controls service department @ (780) 468-5463.

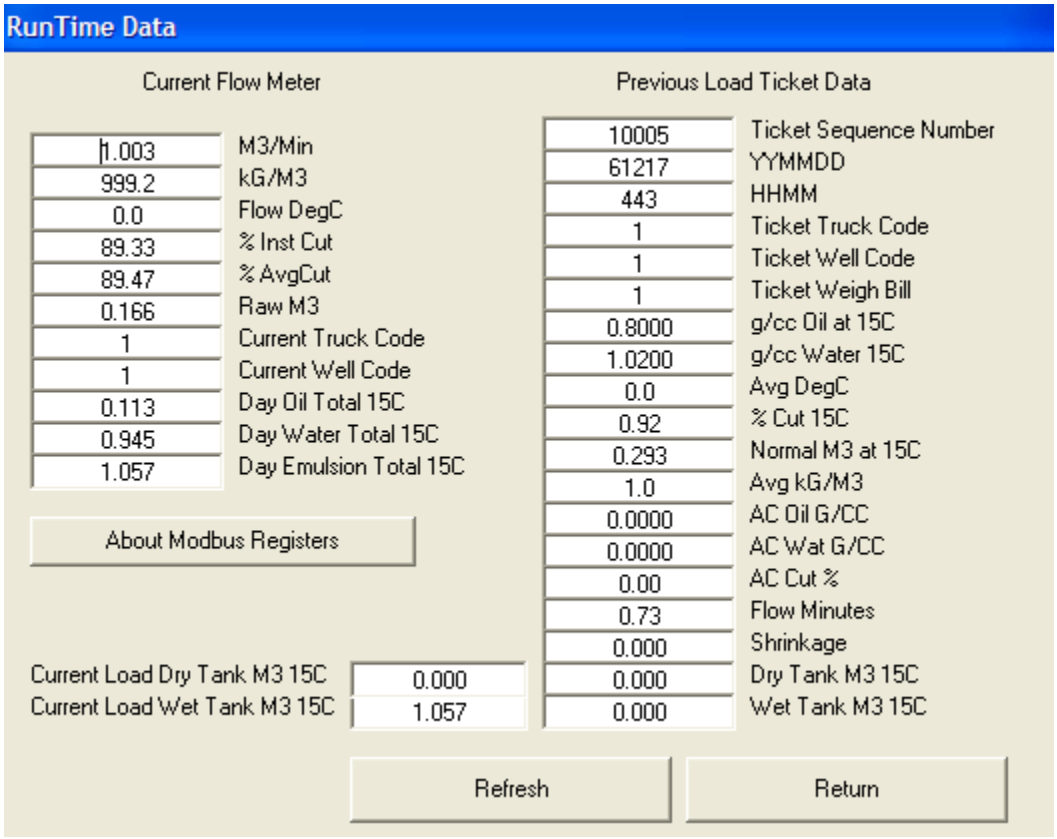
TUSPHD Troubleshooting

Micro Motion and Phase Dynamics data can be viewed from the ROC Clock screen in TUSPHD as shown.



Run Time Data

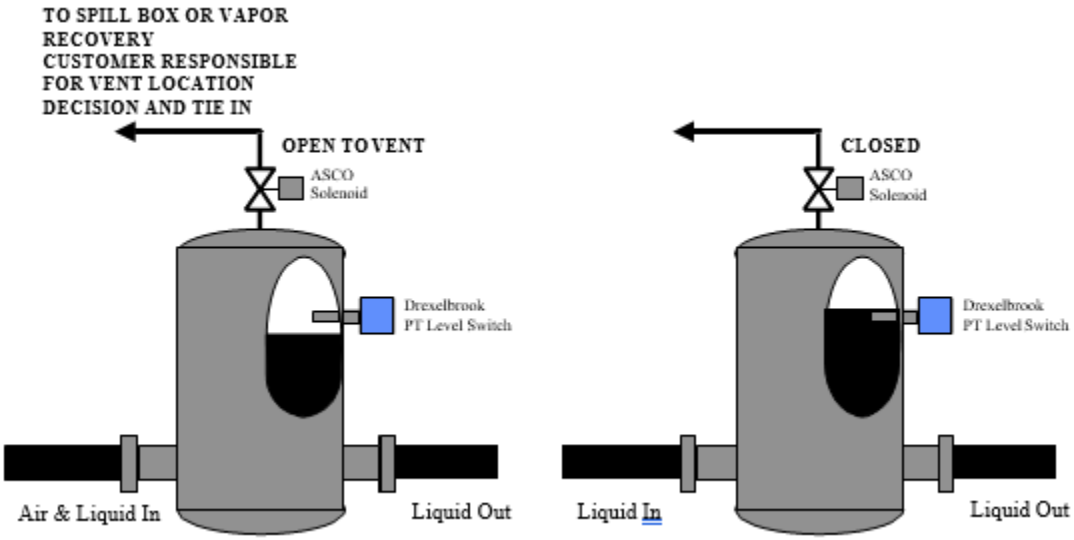
The unloading data can be viewed using the Run Time Data screen in TUSWIN



7.8 Not in Use

7.9 AIR ELIMINATOR

Air Eliminator Operation



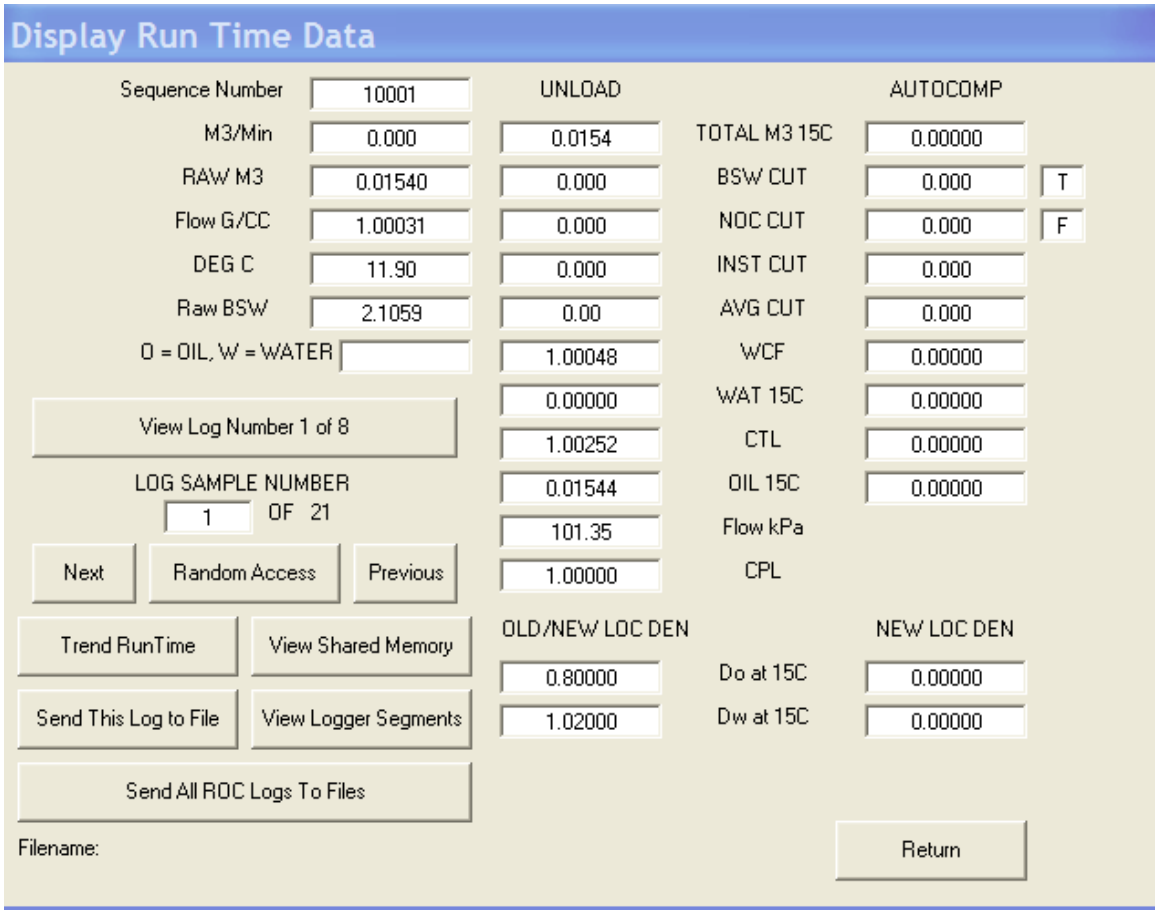
When liquid level in Air Eliminator drops due to in coming gas the level switch opens the vent valve on top of the air eliminator. When liquid level rises to the level switch the vent valve is closed and liquid is pressurized though the metering skid.

SPARTAN CONTROLS

7.10 Not in Use

7.11 Data Logger

This screen allows you to enable data logging of consecutive unload records. The PC has to remain communicating to the ROC for this option as the records will be saved to your hard drive.



Data Log Overview

The following illustrates the data log information available from the system. The data is broken into 3 portions for illustration purposes.

Data portion 1 of 3

LogNum	VolRate	RawAcc	G/CC	DegC	RawBsw	BswCut	UseBsw	NocCut	UseNoc	O/W	CutVal
0	0	0.03112	1.071	15	3.6	0	T	1.541	F		0
1	0.934	0.10893	1.071	15	3.6	0	F	99.999	T	W	99.999
2	0.934	0.26455	1.071	15	3.6	0	F	99.999	T	W	99.999
3	0.934	0.43573	1.071	15	3.6	0	F	99.999	T	W	99.999
4	0.934	0.59135	1.071	15	3.6	0	F	99.999	T	W	99.999
5	0.934	0.66916	1.071	15	3.6	0	F	99.999	T	W	99.999
6	0.934	0.82477	1.071	15	3.6	0	F	99.999	T	W	99.999
7	0.934	0.98039	1.071	15	3.6	0	F	99.999	T	W	99.999
33	1.394	5.35694	0.7172	15	2.1254	1.986	T	0	F	O	1.986
34	1.394	5.61257	0.7172	15	2.1254	1.985	T	0	F	O	1.985
35	1.394	5.72876	0.7172	15	2.1254	1.985	T	0	F	O	1.985
36	1.394	5.96115	0.7172	15	2.1254	1.985	T	0	F	O	1.985
37	1.407	6.19523	0.7107	15	1.9875	0.339	T	0	F	O	0.339
38	1.407	6.42974	0.7107	15	1.9875	0.194	T	0	F	O	0.194
39	1.407	6.54699	0.7107	15	1.9875	0.193	T	0	F	O	0.193
40	1.407	6.7815	0.7107	15	1.9875	0.193	T	0	F	O	0.193
41	1.407	7.01601	0.7107	15	1.9875	0.193	T	0	F	O	0.193

LogNum	Data log number
VolRate	Volume flow rate in M3/min
RawAcc	Accumulated uncorrected volume
G/CC	Density at operating temperature
DegC	Operating temperature
RawBsw	Non density corrected BS&W reading (only valid for water cuts in range of 0-5%)
BswCut	Density corrected BS&W reading (only valid for water cuts in range of 0-5%)
UseBsw	Decision if BS&W is to be used for water cut
NocCut	NOC calculated water cut using existing data base O/W densities
UseNoc	Decision if NOC is to be used for water cut
O/W	Indicator is system is measuring Oil or Water
CutVal	Water cut being reported by system (no Autocomp)

Data portion 2 of 3

1	2.19494	1	3.16137	101.35	1	0.71046	1.05	2.257	T	1.868	F	O
1	2.20001	1	3.41192	101.35	1	0.71046	1.05	2.015	T	1.868	F	O
1	2.20232	1	3.52581	101.35	1	0.71046	1.05	1.996	T	1.868	F	O
1	2.20693	1	3.75358	101.35	1	0.71046	1.05	1.995	T	1.868	F	O
1	2.20965	1	3.98495	101.35	1	0.7107	1.05	0.338	T	0.065	F	O
1	2.21011	1	4.21899	101.35	1	0.7107	1.05	0.206	T	0.065	F	O
1	2.21034	1	4.33602	101.35	1	0.7107	1.05	0.195	T	0.065	F	O
1	2.21079	1	4.57008	101.35	1	0.7107	1.05	0.194	T	0.065	F	O
1	2.21125	1	4.80413	101.35	1	0.7107	1.05	0.194	T	0.065	F	O
1	2.21354	1	4.91803	101.35	1	0.71049	1.05	1.856	T	1.868	F	O
1	2.21585	1	5.03192	101.35	1	0.71046	1.05	1.984	T	1.868	F	O

fWCF	NetWat	fCTL	NetOil	fKPA	fCPL	OilDen	WatDen	BswCutA	UseBsw	NocCutA	UseNoc	O/W
0.99191	0	0.97961	0.03049	101.35	1	0.85	1.05	9.499	T	99.999	F	
1	0.07781	1	0.03049	101.35	1	0.85	1.071	9.499	F	99.999	T	W
1	0.23342	1	0.03049	101.35	1	0.85	1.071	9.499	F	99.999	T	W
1	0.4046	1	0.03049	101.35	1	0.85	1.071	9.499	F	99.999	T	W
1	0.56022	1	0.03049	101.35	1	0.85	1.071	9.499	F	99.999	T	W
1	0.63803	1	0.0305	101.35	1	0.85	1.071	9.499	F	99.999	T	W
1	0.79364	1	0.0305	101.35	1	0.85	1.071	9.499	F	99.999	T	W
1	0.94926	1	0.0305	101.35	1	0.85	1.071	9.499	F	99.999	T	W
1	1.02707	1	0.0305	101.35	1	0.85	1.071	9.499	F	99.999	T	W

fWCF	Water correction factor for temperature
NetWat	Net accumulated water
fCTL	Oil correction factor for temperature
NetOil	Net accumulated oil
fKPA	Pressure at standard conditions
fCPL	Pressure correction factor
OilDen	Oil Density from database
WatDen	Water density from database
BswCutA	AC BS&W
UseBsw	Confirmation to use BS&W
NocCutA	AC water cut reading
UseNoc	Confirmation to use NOC calculation
O/W	Indicator is system is measuring Oil or Water

Data portion 3 of 3

CutValA	fWCFA	NetWatA	fCTLA	NetOilA	OilDenA	WatDenA	NetTtl	NetTtlA	NetCut	NetCutA
9.499	1	0.00296	1	0.02817	0.71046	1.071	0.0305	0.03112	0	9.499
99.999	1	0.08076	1	0.02817	0.71046	1.071	0.1083	0.10893	71.85	74.142
99.999	1	0.23638	1	0.02817	0.71046	1.071	0.2639	0.26455	88.45	89.352
99.999	1	0.40756	1	0.02817	0.71046	1.071	0.4351	0.43573	92.99	93.535
99.999	1	0.56318	1	0.02817	0.71046	1.071	0.5907	0.59135	94.84	95.236
99.999	1	0.64098	1	0.02817	0.71046	1.071	0.6685	0.66916	95.44	95.79
99.999	1	0.7966	1	0.02817	0.71046	1.071	0.8241	0.82477	96.3	96.584
99.999	1	0.95222	1	0.02818	0.71046	1.071	0.9798	0.98039	96.89	97.126
99.999	1	1.03002	1	0.02818	0.71046	1.071	1.0576	1.0582	97.12	97.337
2.257	1	2.57678	1	2.78016	0.71046	1.071	5.3563	5.35694	40.98	48.102
2.015	1	2.58193	1	3.03064	0.71046	1.071	5.6119	5.61257	39.2	46.003
1.996	1	2.58425	1	3.14451	0.71046	1.071	5.7281	5.72876	38.45	45.11
1.995	1	2.58889	1	3.37226	0.71046	1.071	5.9605	5.96115	37.03	43.429
0.338	1	2.58968	1	3.60555	0.71046	1.071	6.1946	6.19523	35.67	41.801
0.206	1	2.59016	1	3.83958	0.71046	1.071	6.4291	6.42974	34.38	40.284
0.195	1	2.59039	1	3.95661	0.71046	1.071	6.5464	6.54699	33.76	39.566
0.194	1	2.59084	1	4.19066	0.71046	1.071	6.7809	6.7815	32.6	38.205
0.194	1	2.5913	1	4.42471	0.71046	1.071	7.0154	7.01601	31.52	36.934
1.856	1	2.59346	1	4.53875	0.71046	1.071	7.1316	7.1322	31.04	36.363
1.984	1	2.59576	1	4.65264	0.71046	1.071	7.2478	7.2484	30.57	35.812

CutValA	AC water cut reading
fWCFA	AC water correction factor for temperature
NetWatA	Net accumulated AC water
fCTLA	AC oil correction factor for temperature
NetOilA	Net accumulated AC oil
OilDenA	AC oil density
WatDenA	AC water density
NetTtl	Net accumulated liquid
NettlA	Net accumulated AC liquid
NetCut	Ave water cut without AC
NetCutA	Ave water cut with AC

7.12 FB107 TUS Startup Procedure

1) GETTING READY The following devices will need site configuration: Drexelbrook Cut Monitor Micro Motion Meter Truck Unloading Panel You will need software: ROCLINK for Windows ROC TUSWIN Drexelbrook HARTWIN CM3 spread sheet Micro Motion Prolink 2 You will need a ROC com cable and a HART modem for the above programs. There may also be Valves, Air Eliminator and a Ground Fault Permissive to set up.	

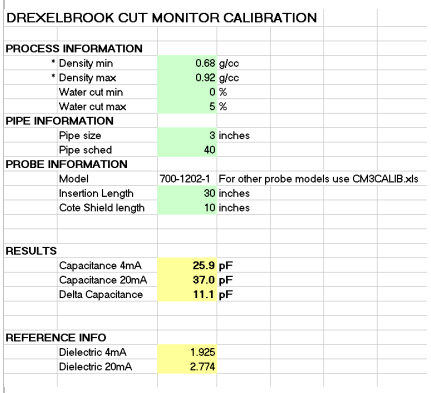
2) Micro Motion Commissioning

With the Micro Motion meter properly installed and wired you will need to complete the following steps using Prolink software:

- Configure outputs
- Frequency VOL (100,000p/M3) for proving
- Configure density slug flow limit 0.5g/cc
- Configure 485 port
- 19,200 None 8 1
- With meter full of liquid and blocked in perform Zero Flow Calibration

3) Drexelbrook Commissioning

With the Drexelbrook properly installed and wired you will need to complete the following steps using HARTWIN software and the CM3 spread sheet:
Calculate Zero & Span using CM3 spread sheet.
Ask site what are the expected min and max oil densities. Include 50Kg/m3 beyond there numbers.
Typical entry is illustrated.
Scale the Drexelbrook for Capacitance values and the ROC for the Dielectric values. You may need to bypass the Drexelbrook I.S. barrier located in the panel when communicating with HARTWIN. Final calibration is completed later.

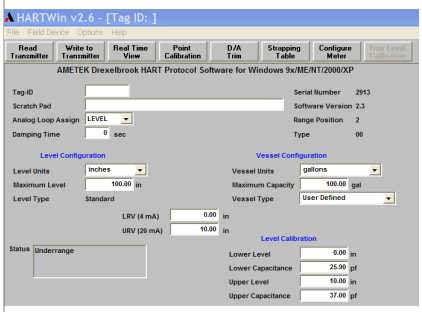


DREXELBROOK CUT MONITOR CALIBRATION			
PROCESS INFORMATION			
	* Density min	0.68	g/cc
	* Density max	0.92	g/cc
	Water cut min	0	%
	Water cut max	5	%
PIPE INFORMATION			
	Pipe size	3	inches
	Pipe sched	40	
PROBE INFORMATION			
	Model	700-1202-1	For other probe models use CM3CALIB.xls
	Insertion Length	30	inches
	Cote Shield length	10	inches
RESULTS			
	Capacitance 4mA	**25.9**	**pF**
	Capacitance 20mA	**37.0**	**pF**
	Delta Capacitance	**11.1**	**pF**
REFERENCE INFO			
	Dielectric 4mA	1.925	
	Dielectric 20mA	2.774	

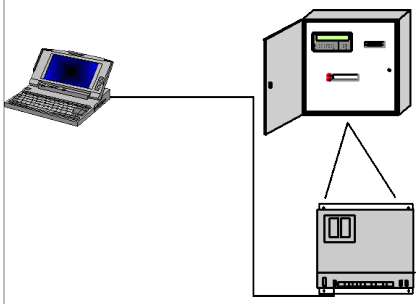
4) CONFIGURE DREXELBROOK
Configure Drexelbrook as per illustration

- Set Analog Loop Assignment to LEVEL
- Set Dampening to 0
- Set Level Units to INCHES
- Set Maximum level to 100
- Set LRV to 0 Set URV to 10
- Set zero and span capacitance per your spread sheet
- Set Lower Level = 0
- Set Upper Level = 10

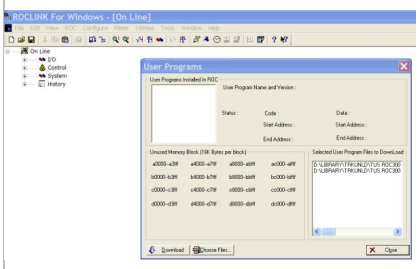
Write to Transmitter



5) TUS SOFTWARE INSTALL
Required for panel software is ROCLINK for windows and TUSPHD software.
Communications are made through the LOI port of the FB107 using a standard ROC communications cable.



6) DOWNLOAD USER PROGRAMS
Download new user programs into FB107 using ROCLINK.

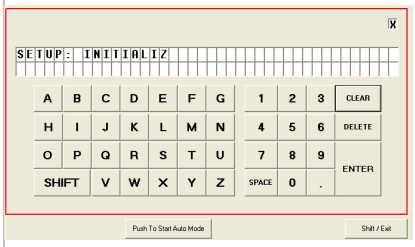


7) CONFIGURE ROC
Refer to the FB107 manual. Basics are:

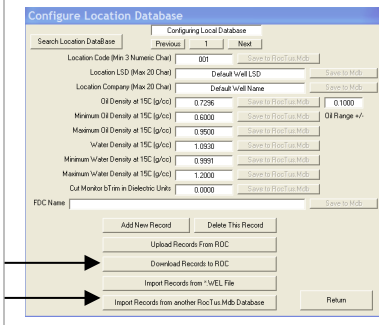
- Set CPU Clock Speed to 14.74 MHz Set Display Port Owner as ROC/MODBUS Slave Turn off AGA's
- Turn off PID's
- Turn off History
- Configure AI's RTD Input enable if using an RTD AI-2 Dielectric (from #4 record)
- COM 1 = 19200, N, 8, 1
- Write to EEPROM (Flags)

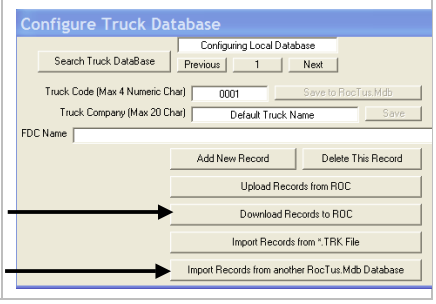
8) CLEAR PROGRAM MEMORY
Using MAP or Proface display Initialize the database in the 107.

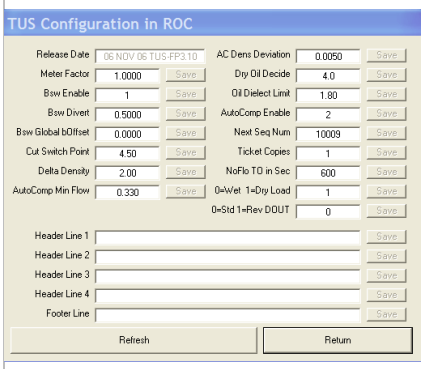
Access Initialize in Menu 2 (Shift 5 accesses menu 2)



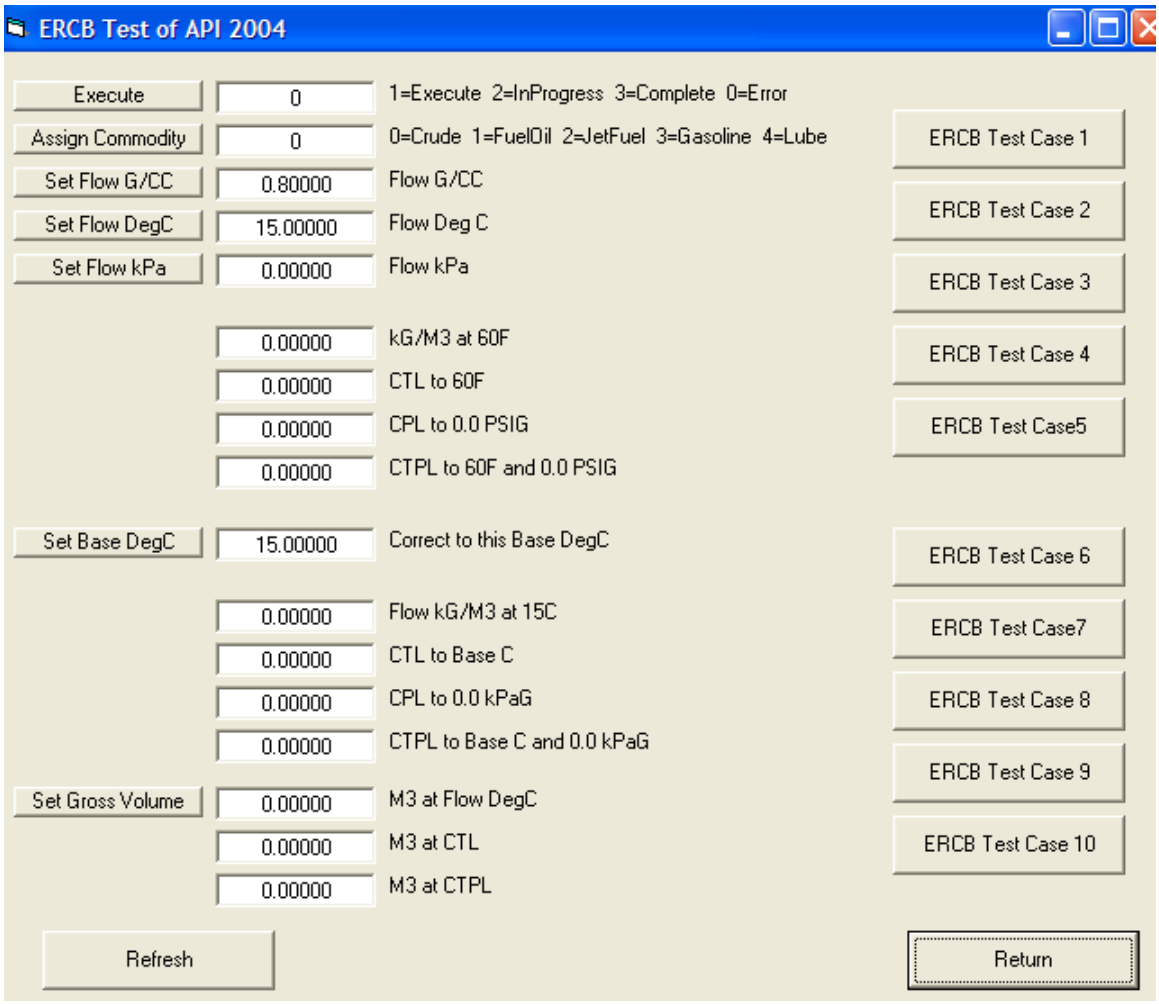
9) CREATE DATABASE
Using the latest version of TUSPHD Create the Location data into the TUSPHD database.
Edit the Oil Range and oil / water limits as required.
Note on limits:
High Water = 1.2
Low Oil = 0.6 will always perform Autocomp.
Download the records to the ROC.



10) CREATE TRUCK DBASE Using the latest version of TUSPHD create the Truck data into the TUSPHD database. Download the records to the 107.	

11) EDIT CONFIGURATION Using TUSWIN edit TUS Configuration as required.	
12) SET UP AIR ELIMINATOR	
13) TEST VALVE OPERATION	
14) CALIBRATE DREXELBROOK The Drexelbrook should be calibrated with a clean truck of oil running through the system. Perform the following procedure while communicating to the Drexelbrook: -Start an unload -Take oil sample and confirm cut -Go to Z screen on MAP (“Shift Z”) -If Kmix < Koil raise your Drexelbrook Z & S numbers until Kmix > than Koil and your water cut is within 1% of spun cut. Example: If Kmix = 2.2 & Koil =2.3 If Drex CZ = 28pF & CZ = 38pF Raise CZ to 29pF and CZ to 39pF and re check, Keep the same spread between the Z&S values. In this example the spread is 39 – 29 = 10 pF While unloading dry oil record water cut reading while taking an oil sample. Adjust Global B trim to match your spun cut. If any individual well reads incorrect in the range of 0-5% water cut you can use the Location B trim to adjust.	Flow rate Water Cut Kmix B trim Emul dens Oil dens Koil T trim 

7.13 Volume Calculation Test Case



7.14 Not in Use

7.15 Not in Use

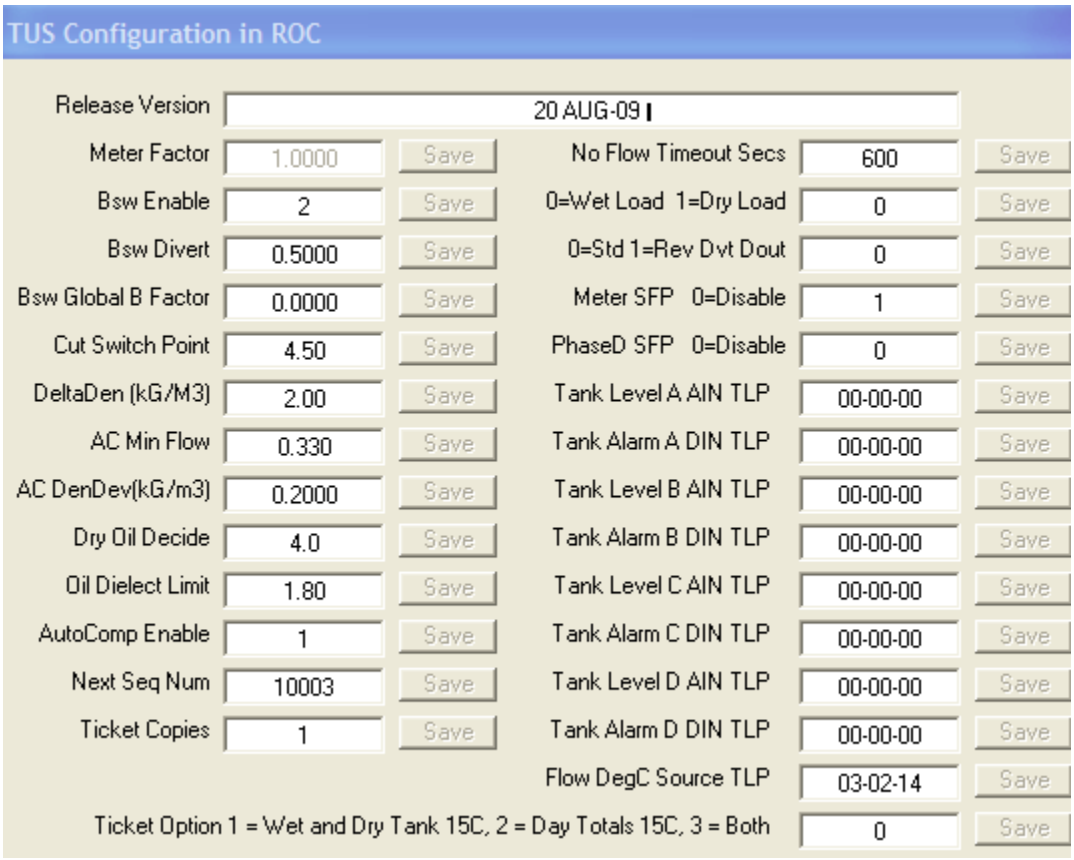
7.16 Totalized Flow Options

The system has the option to print volume totals as follows:

0 Standard Volume Totals (Oil, Water & Emulsion per unload)
1 Wet & Dry Tank Volumes per divert valve operation (per unload)
2 Daily Volume Totals @ 15C
3 All Volumes listed in 0 – 2 options

The ticket will always include oil volume, water volume and emulsion volume as listed in option 0. The other options will add required totals to the ticket as desired. The following illustrates the 4 ticket options:

Configure Using TUS Configuration Screen:



Code 0 Ticket

```
========================================
SEQUENCE NO = 10003




29-OCT-09  15:18
CARRIER:  ABC TRUCKING LTD
TICKET:   1
WELL:     1-2-3-4-5W5
          ABC OIL COMPANY
PRODUCT TYPE: PETROLEUM CRUDE OIL
UNLOAD TIME (min)   : 2.19
TEMPERATURE (degC)  : 15.0
H2O CUT (pcVol)     : 49.4
NET OIL (m3)        : 0.560
NET H2O (m3)        : 0.548
TOTAL VOLUME (m3)   : 1.108
DENSITY (kg/m3)     : 902.29
```

Code 1 Ticket

```
==================================
SEQUENCE NO = 10004




29-OCT-09  15:23
CARRIER:  ABC TRUCKING LTD
TICKET:   1
WELL:     1-2-3-4-5W5
          ABC OIL COMPANY
PRODUCT TYPE: PETROLEUM CRUDE OIL
UNLOAD TIME (min)   : 1.53
TEMPERATURE (degC)  : 15.0
H2O CUT (pcVol)     : 50.3
NET OIL (m3)        : 0.583
NET H2O (m3)        : 0.591
TOTAL VOLUME (m3)   : 1.175
DENSITY (kg/m3)     : 902.29


DRY OIL TANK M3at15C: 0.0000
WET OIL TANK M3at15C: 1.1755
```

Code 2 Ticket

```
================================
SEQUENCE NO = 10005




29-OCT-09  15:28
CARRIER:  ABC TRUCKING LTD
TICKET:   1
WELL:     1-2-3-4-5W5
          ABC OIL COMPANY
PRODUCT TYPE: PETROLEUM CRUDE OIL
UNLOAD TIME (min)   : 1.91
TEMPERATURE (degC)  : 15.0
H2O CUT (pcVol)     : 47.9
NET OIL (m3)        : 0.611
NET H2O (m3)        : 0.563
TOTAL VOLUME (m3)   : 1.175
DENSITY (kg/m3)     : 902.29


DAY OIL TTLM3 at 15C: 1.7559
DAY WTR TTLM3 at 15C: 1.7035
DAY TOTAL  M3 at 15C: 3.4594
```

Code 3 Ticket

```
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SEQUENCE NO = 10006




29-OCT-09  15:41
CARRIER:  ABC TRUCKING LTD
TICKET:   1
WELL:     1-2-3-4-5W5
          ABC OIL COMPANY
PRODUCT TYPE: PETROLEUM CRUDE OIL
UNLOAD TIME (min)   : 1.82
TEMPERATURE (degC)  : 15.0
H2O CUT (pcVol)     : 47.6
NET OIL (m3)        : 0.580
NET H2O (m3)        : 0.528
TOTAL VOLUME (m3)   : 1.109
DENSITY (kg/m3)     : 902.29


DRY OIL TANK M3at15C: 0.0000
WET OIL TANK M3at15C: 1.1095
DAY OIL TTLM3 at 15C: 2.3365
DAY WTR TTLM3 at 15C: 2.2324
DAY TOTAL  M3 at 15C: 4.5689
```