ROC800L Liquid Application Software

The ROC800L Liquid Application Software Suite enables the ROC800 platform to perform API compliant liquid flow calculations. The standard features make the ROC800 ideal for fiscal measurement, LACT unit custody transfer, pipeline metering, batching, meter proving, and custom reporting.

The Liquids Application Software Suite consists of the following program groups:

- Liquid Calculations
- Batch
- Batch Queue
- Proving
- Reporting

Liquid Calculations

The ROC800L Liquid Calculations program measures all of the recognized API hydrocarbon groups.

- Group A – Crude Oils
- Group B – Refined Products (Gasoline, Jet Fuel, Diesel Fuel)
- Group C – Special Applications
- Group D – Lubricating Oils
- Group E – Light Hydrocarbons

The software also provides calculations for the measurement of ethanol and water.

The ROC800L accepts volumetric and mass inputs from positive displacement, turbine, Coriolis, ultrasonic, or other flow measurement devices using single or dual pulse inputs. Meter factors or K-factors can be based on a single value or linearized over a flow range.

The ROC800L Liquid Calculations program performs temperature, pressure, and density corrections and accurately calculates delivered volumes at the standard conditions of one atmosphere (or vapor pressure for light hydrocarbons) and a selected base temperature.

Based on the process temperature and pressure inputs, the software calculates corrections for temperature (Ctl) and pressure (Cpl) for variations from the selected base reference temperature and pressure.

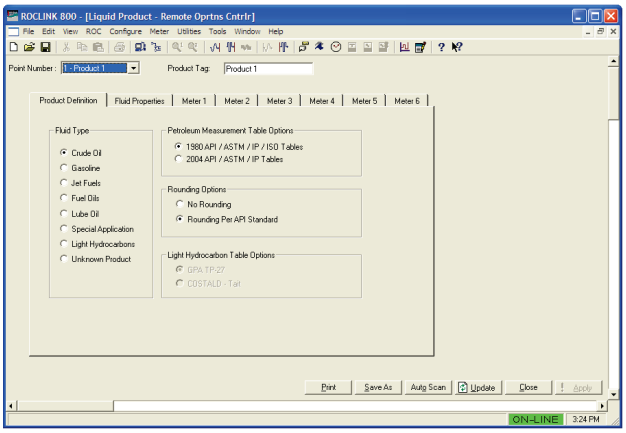
ROC800L Liquid Application Software

Density compensation can be based on an entered product base density or the observed density from a density measuring device such as a Micro Motion Coriolis meter, Micro Motion 7835/7845, UGC, Sarasota, or ITT Barton densitometer. These calculations are based on the latest standards and are performed in accordance with the double precision math recommendations of the GPA and API.

The ROC800L has the ability to account for the mass of each component of a light hydrocarbon stream (ethane, propane, butane, etc) and makes mass to volume conversions in accordance with API 14, API 14.4 (GPA8173), and API 14.7 (GPA 8182). This enables a more accurate determination of the volume for each component of a mixed stream based on a component analysis of the liquid stream. This analysis can come from a connection to a gas chromatograph, providing live data or from manually entered component data. The mass input can be based on either a direct mass measurement from a Coriolis meter or a calculated mass based on a turbine meter input along with flowing density from a densitometer.

The ROC800L also calculates volume loss from evaporation by entering a shrinkage factor for each liquid meter. The accounting for product shrinkage is in accordance with API Chapter 20.1.

The ROC800L calculates vapor pressure based on GPA TP-15 (API Chapter 11.2.4) calculations.



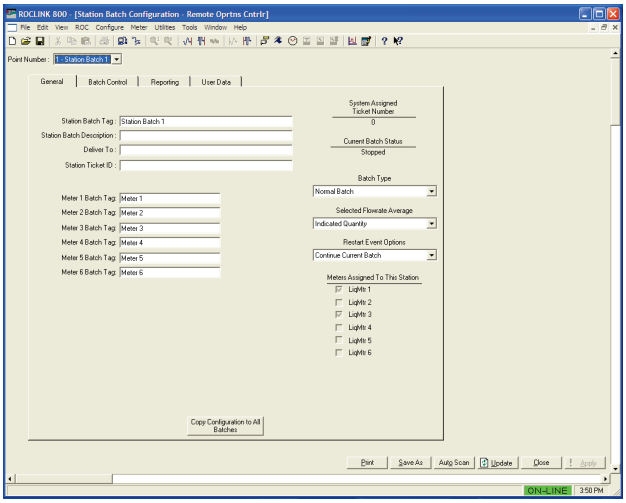
Liquid Product

Batching

Batches are easily configured to record and control the flow of a liquid. A batch can be started and stopped on demand; run for a fixed quantity of fluid; scheduled on an hourly, daily, weekly, or monthly basis; or scheduled to end at a specified time. Batches can also be stopped based on a sensor input such as total accumulated flow, level, interface detection, or other user-configured event.

Batch accuracy is improved through the re-calculation and retroactive calculation features. A completed batch can be re-calculated utilizing user-entered values for the meter factor, K-factor, base density, sediment and water, temperature, or pressure resulting in a more accurate batch total for the already completed batch. When a prove occurs while a batch is in progress, the ROC800L can perform an optional retroactive calculation and apply the resulting meter factor from the prove to the entire current batch.

The batch program can also be configured to automatically create a historical batch transaction at the end of the batch as well as trigger a batch report to be saved or printed.



Station Batch Configuration

Batch Queue

Batch queue is designed to work with product pipelines where the flow in the pipeline is continuous but the products are changing. The queue can be configured to hold the product data for each of the next ten upcoming batches to be placed into the pipeline.

When the batch for one product ends the batch queue can automatically insert the new product data into the liquid calculation program and the batch program so a new batch starts when the previous batch ends.

Proving

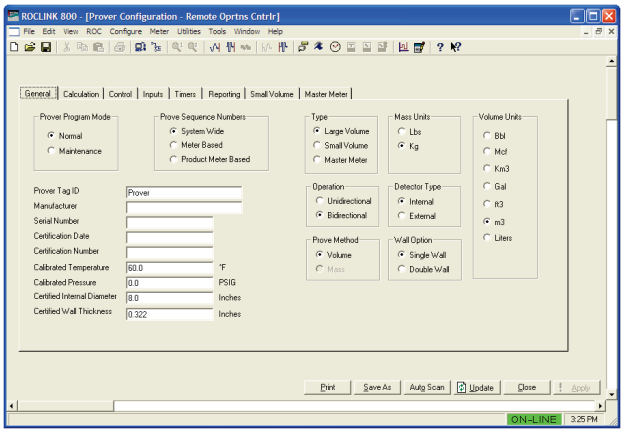
The ROC800L Proving program performs meter proving by operating a 4-way control valve, calculating a new meter factor or K-factor, and storing factor information on up to 24 products for each of up to six meters. The program supports unidirectional and bidirectional large volume provers, small volume provers, and master meter provers.

During a meter proving operation, detector switch inputs start and stop the accumulated pulse counts. A positive-to-negative transition on either detector input generates a time-stamped interrupt with the 30 MHz on-board processor. The system uses this interrupt not only for pulse accumulation between the detectors but also for the pulse interpolation calculations.

Proving operations can be configured to include a selected number of successful runs in a sequence (maximum of 10 runs), set various timing parameters, and maintain accord with desired repeatability standards. The Proving program records and displays all data for a trial run in an easy-to-understand tabular format with color coding to distinguish which results are acceptable in a sequence.

The ROC800L supports the following prove calculation methods:

- Average Meter Factor Method
- Average Data Method Meter Factor
- Average K-factor Method
- Average Data Method K-factor



Prover Configuration

The resulting meter factor or K-factor for a sequence can be compared using both the average data and average meter factor method. The software performs meter factor or K-factor linearization for up to 12 points. The repeatability of a trial run can be viewed based on these methods. Text alarms are provided to indicate the status of the proving sequence, which allows performance monitoring at all times.

The proving feature makes use of the Advanced Pulse Module (APM) that supports dual pulse integrity measurements in accordance with API standards, and provides detector switches to measure the beginning and end of a prover run. For more information on the APM, refer to *Technical Specifications ROC800:APM*.

The module's detector input channels can be used with individually wired detector switches or with detector switches that are wired in series from the prover on the same cable. The detector inputs can be used with relays, open-collector/open-drain solid-state switches, and other two-state devices.

The APM has a dedicated on-board digital signal processor for extremely precise counting of pulses, time interval calculations, and API pulse interpolation calculations.

Reporting and Printing

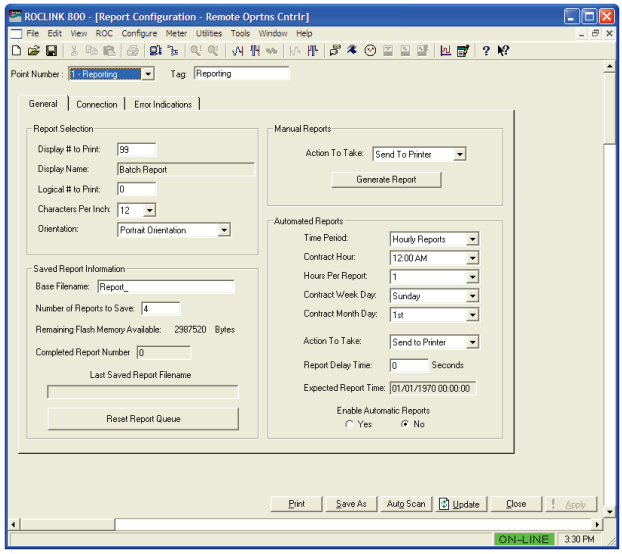
The ROC800L generates reports in compliance with API MPMS Chapter 12.2.2 and 12.2.3. User-configured reports can be created using ROCLINK 800 Configuration Software.

Reports can be printed directly from the ROC800L and/or saved to the flash file system. Multiple printers are supported, including local printers connected to one of the ROC800L serial ports and network printers connected via Ethernet.

The ROC800L now offers a periodic history recording capability to include an hourly, weekly and monthly data for liquid meter runs that enable the ROC800L to generate a report in the CFX format compatible with Flow-Cal v8.0 for export from the ROC800L. This enables external validation of the ROC800L calculations for volume correction.

The ROC800L also offers a transaction history capability to generate reports from batch operations and store the reports for later recall per API, MPMS Chapter 21.2 QTR requirements.

The ROC800L maintains a log of 450 alarms, such as high, high-high, low, low-low, and rate. In addition, the last 1000 weights and measures events are logged.



Report Configuration

ROC800L Software

Liquid Calculations		
Liquids Measured	Group A – Crude Oils Group B – Refined Products (Gasoline, Jet Fuel, Diesel Fuel) Group C – Special Applications Group D – Lubricating Oils Group E – Light Hydrocarbons Ethanol Water	
Density Correction Standards	API standards MPMS Chapter 12.2.1.	
	Tables Used	5A, 5B, 5D, 23A, 23B, 23D, 23E, 53A 53B, 53D, 53E, 59A, 59B, 59D and 59E.
Temperature Correction Standards	API MPMS Chapter 11.1 (1980) / API2540 (1980) / ASTM D1250 / ANSI D1250 / IP200, API MPMS 11.1 (2004) / ASTM D1250-04 / IP200/04, ISO 91.1 (1992) / ISO 91.2 (1991) / IP3 (1988) / API MPMS Chapter 11.1 (2007 Addendum) / COSTALD-Tait.	
	Tables Used	6A, 6B, 6C, 6D, 24A, 24B, 24C, 24D, 54A, 54B, 54C, 54D, 60A, 60B, and 60D.
	For light hydrocarbons	GPA TP27 (2007) / API MPMS Chapter 11.2.4 using tables: 23E, 24E, 53E, 54E, 59E, 60E / COSTALD-Tait / API 14.4
	For Ethanol	OIML R22 (1973) ABNT NBR 5992:2009
	For Water	API MPMS Chapter 11.4.1 (2003)
Pressure Correction Standards	API MPMS 11.1 (2004) / ASTM D1250-04 / IP200/04, API MPMS 11.2.1, API MPMS 11.2.2, API MPMS 11.2.1(M), and API MPMS 11.2.2(M) / COSTALD-Tait.	
Pulse Fidelity	ISO 6551-1982; BS 6439-1983; API Petroleum Measurement Standard, Chapter 5.5, Level A; and Institute of Petroleum Standard, IP 252.76, Part XIII, Section 1, Level A.	
Meter Factor Linearization	Linearization of meter factors or K-factors using up to 12 points to ensure accuracy over the entire range of flow.	
Alarms	Alarms for flow, temperature, pressure and density monitoring.	
Batching		
Queue	Up to ten batches may be placed in the queue. You can easily insert, delete, and rearrange the batches in the queue.	
Trigger	Sets time-based or measurement-based automatic control parameters for batches. Available fields are based on the control method you select. Valid selections are:	
	User Signaled Only	Batches start and stop based on manual commands.
	Hourly Batches	Batches start hourly based on a user-defined value.
	Daily Batches	Batches start daily based on a user-defined value.
	Weekly Batches	Batches start weekly based on a user-defined value.
	Monthly Batches	Batches start monthly based on a user-defined value.
	Measurement Based	Batches are start based on a user-defined value and stop once the batch flow total reaches a user-defined measurement total.

Proving	
Prover Types	Unidirectional and bidirectional large volume, small volume, and master meter provers are supported.
Input Types	The detector inputs can be used with relays, open-collector/open-drain solid-state switches, and other two-state devices. The APM has a dedicated on-board digital signal processor for extremely precise counting of pulses, time-interval calculations, and API pulse-interpolation calculations.
Configurable Parameters	User-configurable to include a selected number of trial runs in a sequence (maximum of 10), set various timing parameters, and maintain accord with desired repeatability standards.
	4 selectable base volumes.
Meter Factor	The resulting meter factor for a sequence can be compared using both the average data and average meter factor method.
Repeatability	The resulting repeatability for a sequence can be compared using both the average data and average meter factor method.
Deviation Checks	Temperature, pressure and flow rate deviation checks.
Metrology Standards	Temperature and pressure correction standards are the same as those listed in the Liquid Calculations section of the table.
Advanced Pulse Module (APM)	Supports dual pulse integrity measurements in accordance with API standards, and provides detector switches to measure the beginning and end of a prover run. For more information on the APM, refer to *Specification Sheet ROC800:APM*.
Master Meter Proving	User selectable criteria based on volume, pulses or time.
	12-point meter factor linearization for the master meter.
Small Volume Proving	Dual Chronometry Pulse Interpolation provides fractional pulses for small volumes.
	Automated pneumatic spring plenum pressure control.
	Selectable number of passes per trial run.
Data Results	Records and displays all data for a trial run in an easy-to-understand tabular format with color coding to distinguish which results are acceptable in a sequence.
Reporting	
Report Types	Predefined reports for QTRs (Quantitative Transaction Reports) and Bills of Lading are available. User-defined reports can be created with ROCLINK 800.
CFX Format reports	The ROC800L is capable of generating a report that conforms to Flow-Cal version 7.05 in the CFX format. This format is compatible with Flow-Cal version 8 enterprise software. A separate software key (8KY-9) is needed to enable this capability.
Metrology Standards	Generated reports comply with the following standards:
	API MPMS Chapter 12.2.2 and 12.2.3.
	NIST Handbook 44 – 2002 Edition and 2003 Update and NCWM Chapter 14.
Alarm Log	Maintains a log of 450 alarms, such as high, high-high, low, low-low, and rate. In addition, the last 1000 weights and measures events are logged.
Event Log	Standard log 0f 450 events and 1000 weights and measures events
Printing	Reports can be printed directly from the ROC800L. Both serial port printers and network printers connected via Ethernet are supported.

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