

## MODEL 0511/0512

# PetroCount RMS RATIO MANAGEMENT SYSTEM

### DESCRIPTION

The Instrument PetroCount Ratio Management System (RMS) is a rugged yet compact electronic preset designed to simultaneously blend up to 4 products in-line through a single load arm. It provides precise batch delivery for custody transfer of petroleum, industrial and chemical products. Programming the PetroCount RMS is easily performed by selecting the desired options from built-in menus. Available enclosures include Division 1 explosion proof and Division 2 hazardous area operation.

The PetroCount RMS Main Control Unit is equipped with a rugged operator interface with display and keypad. Delivered quantities are displayed on a large 8-character numeric display. Operator prompts and program menus are presented on a 32-character alphanumeric display. A sixteen pushbutton keypad provides pushbuttons 0-9, Start, Stop, Reset, Select, Repeat and Enter. These are used for controlling the batch delivery sequence and for programming the user selectable data base parameters. An integral Weights and Measures security switch secures the data base against tampering.

The Main Control Unit can blend two product streams. By adding the optional Satellite Control Unit, the blending of 3 or 4 product streams is accomplished. The Satellite Control Unit also provides for a "tally meter" in the blended product stream if required by local weights and measures authorities.

Additive meter pulse inputs are provided for total additive system control and monitoring. By controlling a solenoid valve and monitoring the pulse output from an additive meter, the PetroCount RMS will perform all those functions common to the most sophisticated additive systems. Additive totalizers, electronic calibration of the additive system, automatic additive rate adjustment and additive alarms are all integral functions of the RMS.



### ⚠ WARNING

**Do not operate this instrument in excess of the specifications listed. Failure to heed this warning could result in serious injury and/or damage to the equipment.**

### DESIGN FEATURES

- 50 Configurable Recipes with Optional Line Flush
- Additive Meter Pulse Inputs for Total Additive System Monitoring and Control
- 20 Solid State Relays for Control (with Satellite Unit)
- Integral Weights and Measures Security Switch
- 4 Permissive Sensing Circuits (2 AC and 2 DC)
- 4-Wire RTD Temperature Measurement for individual Product Stream
- Digital Valve Control with Automatic High Flow Rate Recovery
- Programmable Flow Profiles per Recipe
- Temperature Compensation per API Tables
- Easily Serviced - All Plug-in Circuit Boards
- Configurable Meter Ticket/BOL with Multidrop to Single Printer
- 2 Independent Data Communications Ports with Built in Communications Analyzer
- Archival Data Storage
- Non-Volatile Memory Retention (10 years)

## PRINCIPLE OF OPERATION

The PetroCount RMS in-line blending system offers a total solution for the metering and control requirements for most blending applications. Simply program the unit for the specific functions of your blending application via the keypad or the data communications interface. The user friendly display format prompts the operator through the entire loading sequence assuring a safe and reliable loading operation.

The PetroCount RMS loading sequence starts with the operator selecting a blend, entering a preset quantity and pressing "start". The RMS will automatically turn on the required product pumps, additive injection equipment and open the digital flow control valves. A low flow start sequence can be initiated to reduce static build up when delivering petroleum products. The component ratios are continually controlled and monitored by the high speed blend control algorithm. The RMS is designed to automatically maintain the highest possible flow rate that the system can deliver to keep loading time to a minimum.

Three different flow profiles are available for each recipe providing for maximum system flexibility regardless of the meter size. When certain recipes require small percentages of one or more components the *programmable flow profiles* feature can be configured to automatically deliver the small percentage component(s) only during the high flow stage of the delivery. This will allow the flow meter(s) to operate above the minimum flow range as specified by the manufacturer. In extreme cases, the *programmable flow profiles* feature can be configured to pulse the smaller percentage component(s) during the high flow period to maximize system performance.

As the PetroCount RMS approaches the end of the batch sequence, the component streams will be slowed down to a low flow stop flow rate. The high speed digital valve control algorithm working in conjunction with the linear digital control valve ensures a smooth, repeatable low flow stop and final stop without line shock.

An automatic single product line flush sequence can be programmed at the end of the delivery to flush the loading arm with a single base product. This automatic sequence assures product quality when multiple blends are loaded through the same loading arm.

The PetroCount RMS is equipped with digital output circuits that can be configured for volume/pulse outputs for data acquisition type devices.

The PetroCount RMS can be configured to print a variety of reports to a serial printer. Up to 32 RMS/SMS units can be multidropped on 1 communications interface for report printing. The available reports include a configurable meter ticket/bill of lading, data log printout, and inventory totals printout. The printing features allow the RMS to perform as a stand alone transaction accounting system or provide backup to an existing automation system.

The following instrument specifications apply to the Main Control Unit and the Satellite Control Unit. Instrument power is required for all Control Units.

## ELECTRICAL

### Instrument Power

- 115 Vac Configuration: 95 Vac to 135 Vac, 47 Hz to 63 Hz.
  - 0.25 amp maximum without heaters operating
  - 1.00 amp maximum with heaters operating
- 230 Vac Configuration: 190 Vac to 270 Vac, 47 Hz to 63 Hz.
  - 0.125 amp maximum without heaters operating
  - 0.500 amp maximum with heaters operating

## INPUTS

### Meter Pulse Inputs

- 12Vdc Source Mode** (Intended for pulsers that generate a 12Vdc pulse)
  - Threshold: 6.3 Vdc  $\pm$ 0.5 Vdc
  - Input Resistance: 1.5 k ohms
  - Maximum Input Voltage: 30 Vdc
  - Maximum Input Frequency: 10 khz

- 5Vdc Source Mode** (Intended for pulsers that generate a 5Vdc pulse)
  - Threshold: 2.0 Vdc  $\pm$ 0.4 Vdc
  - Input Resistance: 2.0 k ohms
  - Maximum Input Voltage: 30 Vdc
  - Maximum Input Frequency: 10 kHz

- Sink Mode** (Intended for pulsers with open collector or contact closure outputs.)
  - Nominal Applied Voltage: 12 Vdc
  - Nominal On Current: 8.0 mA
  - Maximum On Resistance: 700 ohms
  - Maximum On Voltage: 4.0 Vdc
  - Maximum Off Leakage: 1.0 mA
  - Maximum Input Frequency: 10 kHz

- Digital Inputs** (For use with open collector or contact closure inputs only.)
  - Nominal Applied Voltage: 12 Vdc
  - Nominal Operating Current: 6.0 mA
  - Maximum On Resistance: 1.5 k ohms
  - Maximum On Voltage: 4.0 Vdc
  - Maximum Off Leakage: 0.5 mA
  - Minimum Pulse Width: 15 ms

### AC Permissive Power Detect Inputs

- Input Voltage: 90 Vac to 270 Vac (47 Hz to 63 Hz)
- Input Impedance: 56 k ohm Minimum

### PRTD Inputs

- Connection Type: 4 wire
- Accuracy:  $\pm$ 0.25°F ( $\pm$ 0.139°C) over range of -50°F to 450°F (-45.6°C to 232°C)
- Drive Current: 1 mA

### Current Loop Inputs

Input Resistance: 110 ohms  
Nominal Input Current: 4-20 mA  
Maximum Input Current: 45 mA

### OUTPUTS

#### AC Solid State Relays

Load Voltage: 24 Vac to 280 Vac (25 Hz to 70 Hz)  
Maximum Current: 1.5 Amp  
Maximum Off State Leakage: 6.0 mA  
Maximum On State Voltage Drop: 1.6 Vac

#### DC Solid State Relays

Load Voltage: 3.0 Vdc to 60  
Load Current: 0.01 amps.dc to 1.5 amps.dc  
Maximum Off State Leakage: 1.0 mA dc  
Maximum On State Voltage Drop: 1.85 Vdc

### Digital Outputs

Maximum Off State Voltage: 60 Vdc  
Maximum On State Voltage: 1.0 Vdc (I=0.25 A)  
Maximum On State Current: 1.0 A  
Maximum Off State Leakage: 1  $\mu$ A  
Maximum Output Frequency: 1 kHz

### DC Power Sources (For use with Pulsers, Digital Outputs and Current Loop Transmitters.)

+12 Vdc Regulated at 300 mA, Fused at 750 mA  
+24 Vdc Unregulated at 100 mA, 1% ripple maximum, fused at 250 mA

### AC Power Sources for Use with Relays

Line Power Fused at 3 amps  
Permissive Power Fused at 3 amps

### ENVIRONMENTAL SPECIFICATIONS

#### Temperature

Operating: -40 to 122°F (-40 to 50°C)  
Storage: -40 to 158°F (-40 to 70°C)

#### Thermal Shock

No harmful effect for:  
Operating-Less than 1°C/min;  
Storage-Less than 3°C/min

#### Humidity

0-95% (Non-condensing)

#### Vibration

S.A.M.A. Standard PMC 31.1 - 1980 Section 5.3  
(Condition #2 - Field Mounted)

#### Shock

Drop and Topple Test from a height of three feet when packaged in its normal shipping container

### EMI/RFI

S.A.M.A. Standard PMC 33.1 - 1978, "Electromagnetic Susceptibility of Process Control Instrumentation", Classification 2-abc; No Error  
EMC Directive: CE Mark as per EMC directive 89/336/EEC

### Salt Fog

NEMA 4X

**Dimensions** See Figs 14 & 15

### AGENCY APPROVALS

#### Safety

UL/cUL Division 1 explosion proof enclosures are designed to UL and cUL specifications in NEC Class 1, Groups C & D, Division 1 or Class II, Groups E, F and G hazardous locations.

Division 2 hazardous locations enclosures are designed to UL and cUL specifications in NEC Class 1, Groups A, B, C & D, Division 2.

CENELEC Designed to CENELEC specifications per code EEx d IIB T6

### Weights and Measures

- NIST/NTEP  
- CCA - Canada

### RATIO MANAGEMENT SYSTEM FEATURES

#### Hardware Configuration

The Main Control Unit comes standard with an operator interface and is capable of 2 stream in-line blending. By easily adding the Satellite Control Unit the RMS is expanded to 3 or 4 product streams. Reference Figure 2 and 3.

#### Tally Meter

Metering the blended stream is not a requirement for in-line blending but is required in some applications. The tally meter feature is software configurable for easy setup. The optional Satellite Control Unit is required for all tally meter applications. Reference Figure 3 Option 2.

### Additive Metering

Up to 4 additive meter pulse inputs (2 per each tub) are available for complete additive system monitoring and control (See Figure 4). Simply install a small P.D. or Coriolis meter with pulse output and solenoid valve in the additive line and the RMS will turn on the additive pump, control the injection of additive, totalize and print all additive information. The PetroCount can handle up to 10 additives.

Additional features include the option to stop injecting additive during the low flow stop stage to flush the line of all additives in preparation for the next delivery. The RMS automatically increases the injection rate during the low flow start and high flow stages of the delivery to compensate for the additive line flush. Additive rate and valve failure alarms ensure all additives are injected in the proper quantities. Additive rate and valve failure alarms ensure all additives are injected in the proper quantities.

### Blend Recipes

Fifty blend recipes are available in the memory of the PetroCount RMS unit. Each recipe has individual totalizers and is highly configurable providing maximum flexibility. Recipe configuration includes:

<b>Recipe Name</b>	<b>Additive Selections</b>
<b>Ratio of Streams 1 - 4</b>	<b>Final Stream Adjustment Factor</b>
<b>Low Flow Start Flow Rate</b>	<b>Temperature Compensation Enable</b>
<b>High Flow Rate</b>	<b>CTL Method</b>
<b>Low Flow Stop Flow Rate</b>	<b>API Table Selection</b>
<b>Flow Profile Option</b>	<b>Density/Alpha</b>
<b>Line Flush Enable</b>	<b>Reference Temperature</b>

### Programmable Flow Profiles

Each blend recipe can be configured for one of three different flow profiles for controlling the delivery sequence: all stage blending, high flow only, cycle high flow only.

When a recipe is programmed for "All Stage Blending" (Figure 5) each component of the blend will be delivered during each loading stage; low flow start, high flow and low flow shut down.

When multiple recipes are loaded through the same loading arm with a wide range of component ratios the "High Flow Only" option (Figure 6) will help maximize the system flow rangeability. The "High Flow Only" option delivers the non-primary (lower percentage) components during the high flow stage only. This will increase the average flow rate of the non-primary component stream(s) in order to stay above the minimum flow range of the flow meter(s).

In extreme cases where a component ratio is very low the "Cycle High Flow Only" option (Figure 7) will cycle the low percentage component(s) in order to keep the component stream flow rate at or above the minimum flow rate of the flow meter.

### Blend Control

A high speed blend control algorithm commands the Model 788 digital control valve for precise ratio control of all component streams. Automatic flow rate adjustment occurs on all component streams should one stream fall behind its flow rate set point. An "automatic high flow recovery" sequence will allow the system to recover to the high flow set point should the pumping system allow.



Figure 1 CMF10 with RFT9739 transmitter

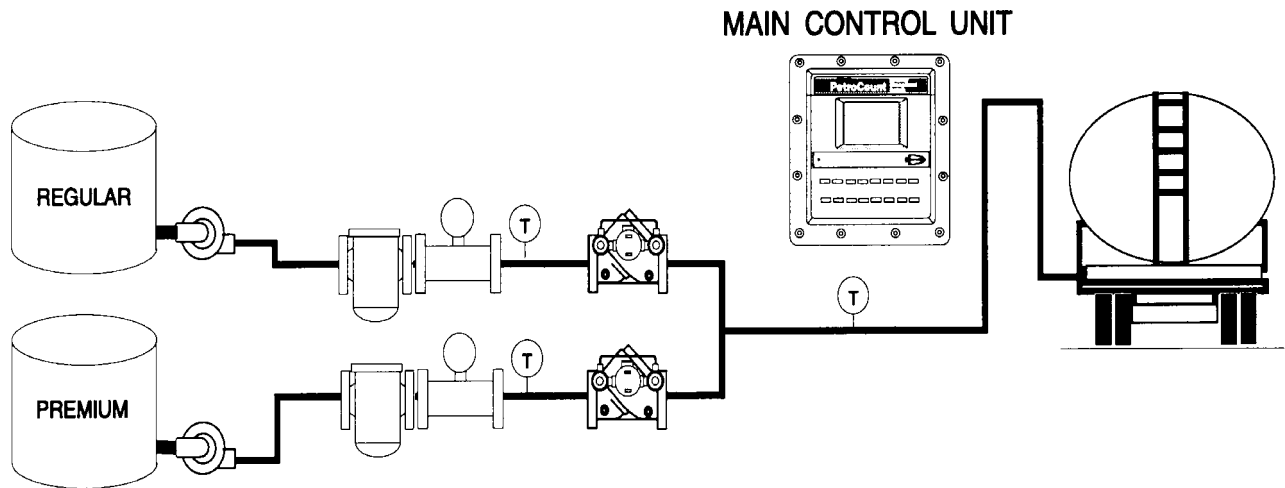


Figure 2 Two Stream Blender

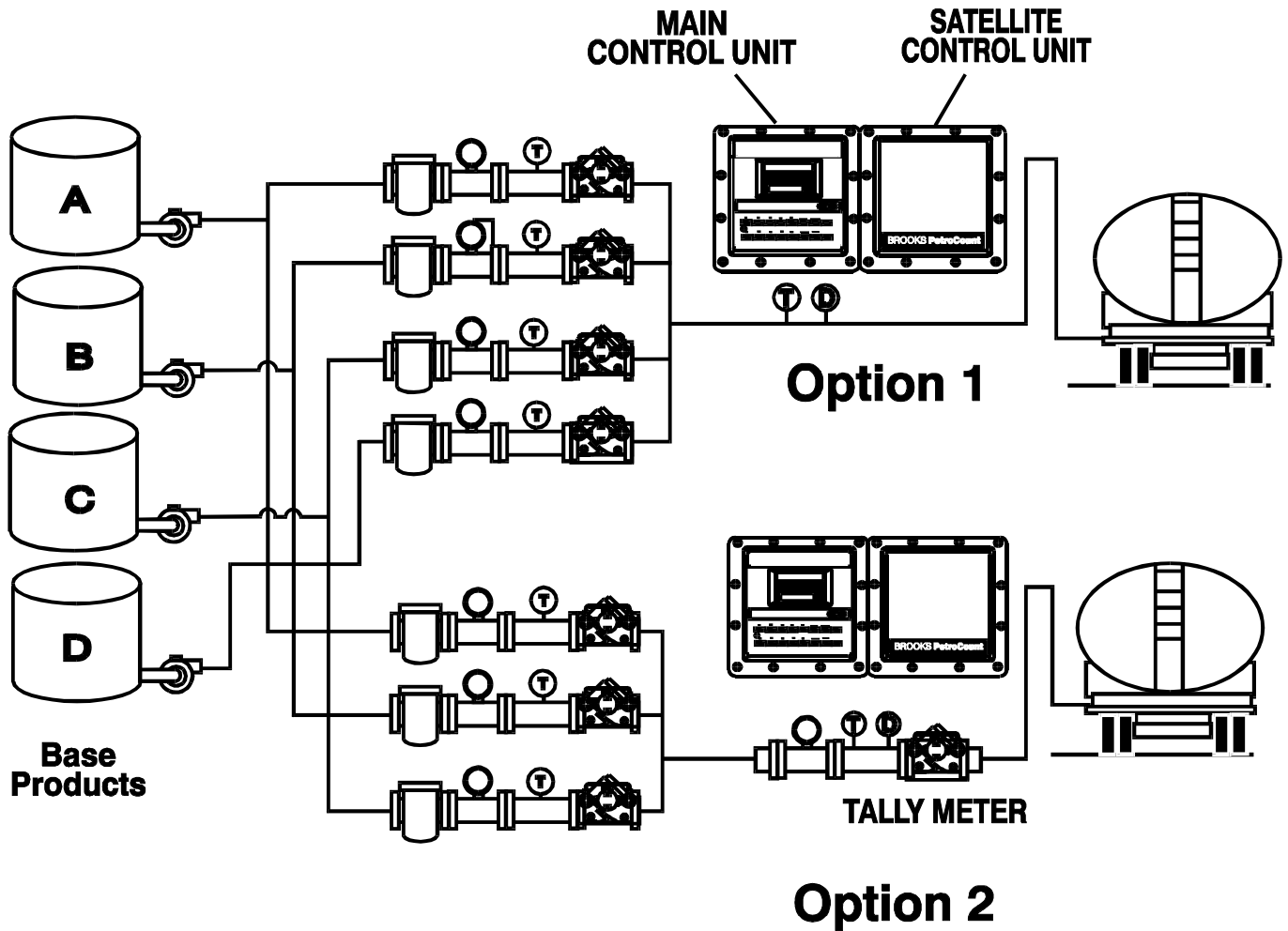


Figure 3 Four Stream Blender and three stream blender with tally meter

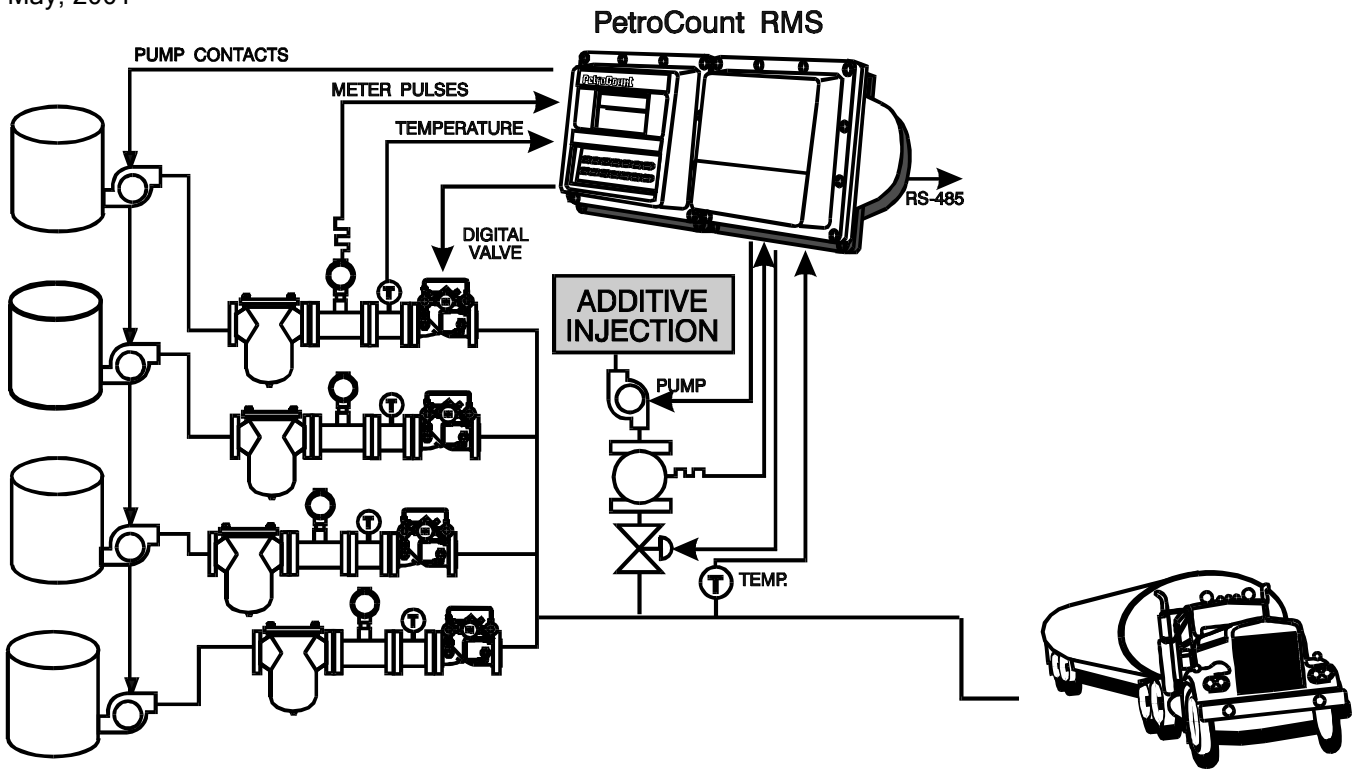


Figure 4 Loading Rack Applications - Additive Metering

**Line Flush**

A single product line flush can be programmed in each recipe to assure product quality between blends. The flush is always the last product delivered and does not have to be one of the components of the recipe.

**Permissive Sense**

Two AC (one per tub) and two DC permissive inputs are provided for detecting the status of different permissive circuits. Each input has a programmable prompt for telling the operator which circuit is inactive.

**Data Acquisition**

Four separate digital signals are provided for volume/pulse signals to automation systems. Each output is programmable for a component stream or the blended stream.

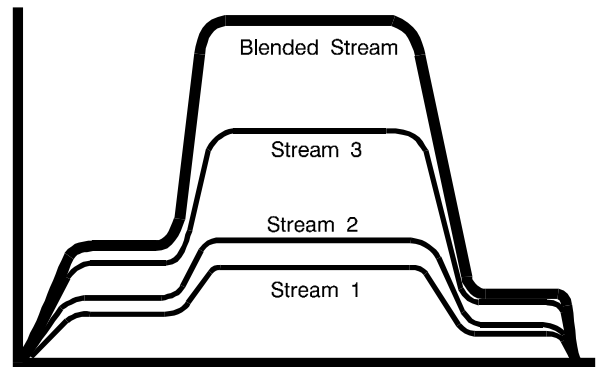


Figure 5 All Stage Blending Control

### Relay Options

The Main Control Unit and the Satellite Control Unit can each be ordered with 5ac, 10ac or 5ac/5dc solid state relays.

### Meter Factor Linearization

Flowmeter accuracy is maintained with programmable multi-point linearization. The PetroCount RMS automatically interpolates between the 4 meter factor set points assuring system accuracy over the required flow ranges.

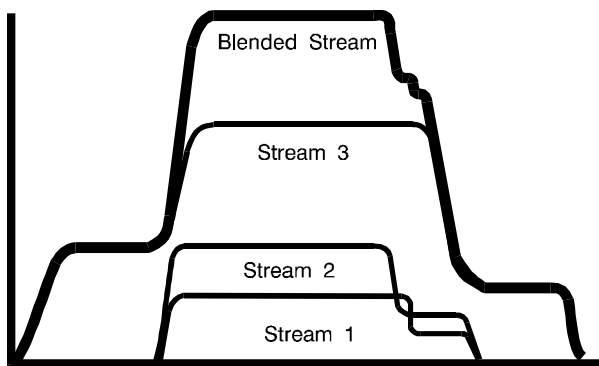


Figure 6 High Flow Only

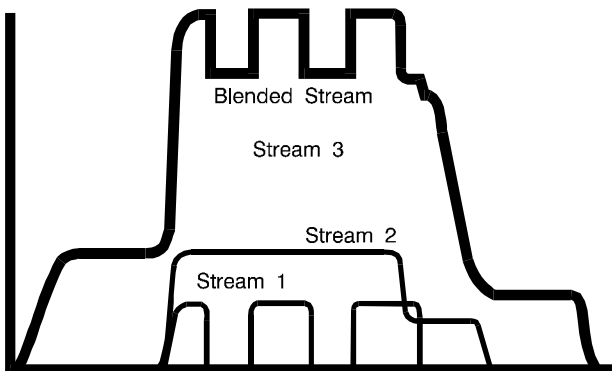


Figure 7 Cycle High Flow Only

### Operator View Screens

Over 100 separate data base variables are available for instantaneous operator viewing. These parameters may be viewed but not changed by the operator and include:

Flow Rate	Delivered Gross	Current Time
Temperature	Delivered Net	Meter Factor
Gross Totalizer	Component Ratio %	Additive Quantity
Net Totalizer	Density	W & M Counter

### Alarms

Built in programmable alarm conditions are user-selectable and may be programmed to monitor one or more of the following conditions:

Low Flow Rate	Instantaneous Blend Ratio
High Flow Rate	Final Blend Ratio
Preset Over Delivery	Pulse Security
Preset Under Delivery	Pulser Failure
Additive Failure	Valve Failure
Temperature	Flow Ratio
Diagnostic	User Configuration
User Configurable	Power Failure
Communications	

### Pulse Security

Dual pulse signals, 90 degrees out-of-phase, can be monitored for error conditions which can occur because of electrical noise or faulty pulse generating components. The PetroCount performs the pulse security function in accordance with API Petroleum Measurement Standard, Chapter 5.5, Level B, and Institute of Petroleum Standard, IP 252/76, Part XIII, Section 1, Level B.

### Temperature Compensation

The temperature compensation method is programmable for linear equation or from API tables 6A, 6B, 6C, 6D, 24A, 24B, 24C, 24D, 54A, 54B, 54C, 54D. The component streams and the blended stream (by recipe) can be compensated independently.

**Density Compensation**

The fluid density is required for temperature corrections when the API table option is used. Manual entry is the only method for entering density values.

**Analog Inputs**

The analog option provides for three 4-wire RTD inputs for high precision temperature measurement of the component streams and/or blended stream. Two 4-20mA analog inputs are also provided for temperature transmitters. When the Main Control Unit and the Satellite Control Unit are equipped with the analog option a total of six RTD inputs and four 4-20mA inputs are available.

**Recipe Selection**

The PetroCount RMS can be configured to prompt the operator with a scrolling menu of recipe names or by entering a 2 digit recipe number. If only one recipe is required a default recipe can be selected eliminating the recipe selection process.

**Data Communications**

Two independent data communications ports are provided for remote access and control using either computer mode or terminal mode. Communications port #1 is jumper configurable for RS232 or RS485 multidrop. Communications port #2 is dedicated RS485. Each port can be configured with unique data rates up to 19,200 baud, word size (8 or 7), stop bits (1 or 2) and parity (none, odd or even). Both communications ports are electrically isolated from all I/O circuits providing for superior noise immunity and performance. A communications analyzer and communication port alarms are provided to aid in system diagnostics.



Figure 9 Retrofit Kit for Existing Petrocount IMS Housings

**Archive Memory Storage**

Archival memory storage of all transaction information is maintained even after a power outage. The archive function can be configured to stop all loading should the memory storage become full. Some available archive parameters include:

Transaction Index	Stream Weighted Avg Temp.
Alarm History	Blended Stream Avg Temp.
Time/Date	Additive Delivered
Recipe Number	Preset Quantity
Gross/Net Delivered	

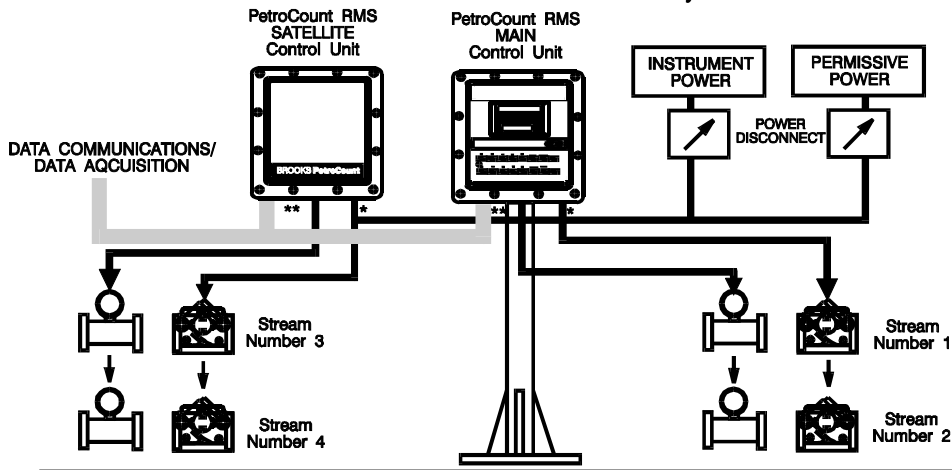
**Data Security**

Program data is secured with an eight digit user defined access code. All calibration data is secured with the access code and a wire sealable mechanical security switch that is integrally mounted in the PetroCount display door.

**Printing Options**

Up to 32 PetroCount RMS Control Units can be multidropped to a serial printer for printing the following reports for recording transaction details and data base maintenance:

- Data Log
- Bill of Lading/Meter Ticket (Configurable)
- Inventory Totals Printout



ALL WIRING AND CONDUIT MUST COMPLY WITH CODE REQUIREMENTS FOR DIVISION 1 LOCATIONS.

\* Right hand conduit entrance on each enclosure for power and high level control circuits.

\*\* Center and left hand conduit entrances on each enclosure for low level I/O circuits.

NOTE: Maximum cable length for communications cable between Main and Satellite Control Unit is 25 feet.

Figure 8 Installation Considerations

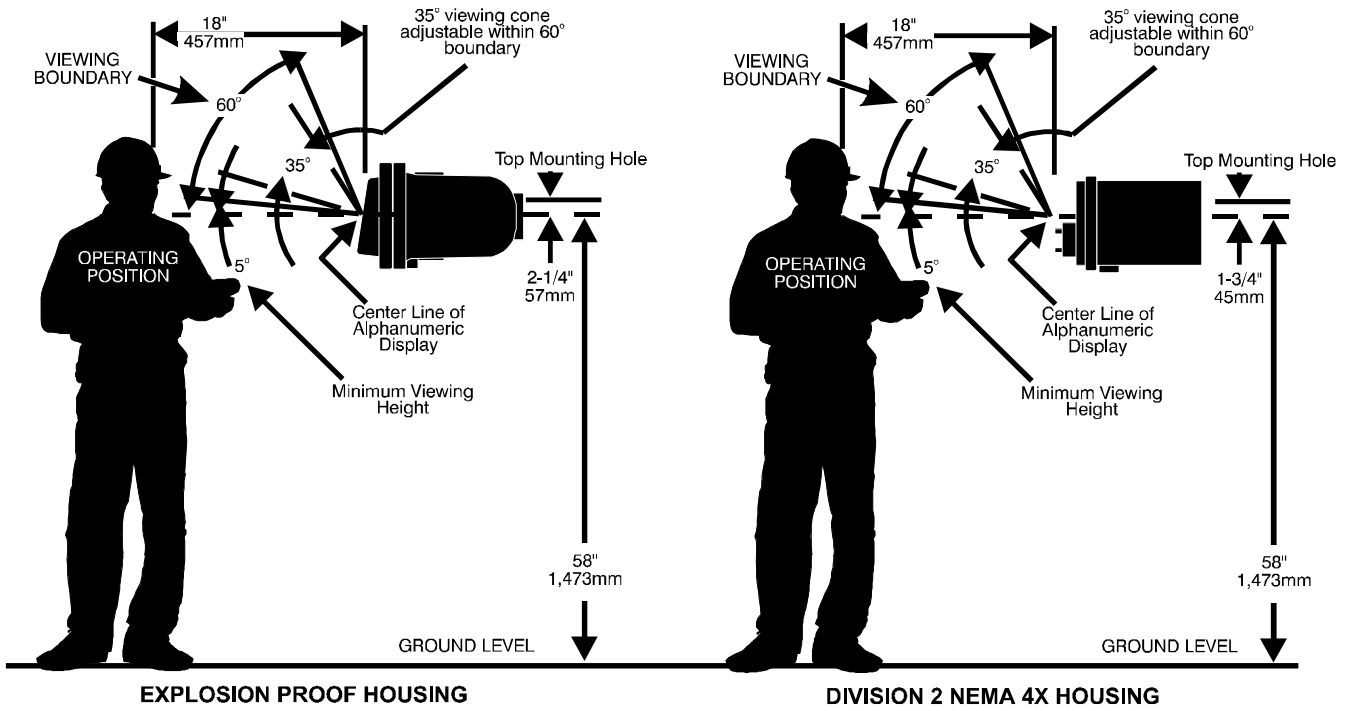


Figure 10 Mounting Considerations

Deliver To:

Charge To:

Driver ID Number: 5836479

Order Number: 2345

Date: 10/15/92

Time In: 08:14:42

Time Out: 08:21:27

Product	Meter ID	Gallons Gross Qty	Gallons Net Qty	F° Temp	API Density	Additives	cc's Quantity
89 OCT	3C	1000.05	993.25	----			
--Regular		599.92	595.96	72.5	46.3	add 1	3985.2
--Premium		400.13	397.29	73.6	47.2	add 2	2375.8

Figure 11 Typical Printed Ticket (Reduced from Original Size)

Driver <u>I.D.</u>	Unit <u>Addr.</u>	Gross <u>Delv.</u>	Net <u>Delv.</u>	Gross <u>Total</u>	Net <u>Total</u>	Time <u>In</u>	Time <u>Out</u>	<u>Temp</u>
00038729	203	2000.07	1978.88	2924092	8968417	16:35	16:40	----
Super		600.02	594.14	836513	828984			78.5
Regular		1199.97	1188.45	1988294	1970396			77.9
MTBE		200.08	198.48	99285	984906			80.3
Add 1 = 7645.3cc's								
00882651	605	2999.96	2974.46	3809914	3579002	16:37	16:42	----
Super		2999.96	2974.46	3809914	3579002			78.7
Add 3 = 11358.4cc's								

Figure 12 Typical Data Log Printout

Inventory Totals Report

PetroCount RMS #204

Date/Time of Printout: 10/15/92 07:58:25

Product	Previous Reading	Current Reading	Change
Gross Totalizers			
Regular	754833.54	785582.23	30748.69
Super	97884.46	138835.87	40951.41
MTBE	48331.13	58229.32	9898.19
Alcohol	42004.56	49893.12	7888.56
Net totalizers			
Regular	749549.70	780082.92	30533.22
Super	97149.87	137793.73	40643.86
MTBE	48089.34	57937.85	9848.51
Alcohol	41709.97	49543.74	7833.77
Additives			
Add 1	4839.29	4892.19	52.90
Add 2	2883.20	2945.56	62.36
Add 3	7399.75	7479.36	79.61
Add 4	18226.39	18332.79	106.40

Previous Reading 10/14/92 07:55:30

Figure 13 Inventory Totals Printout

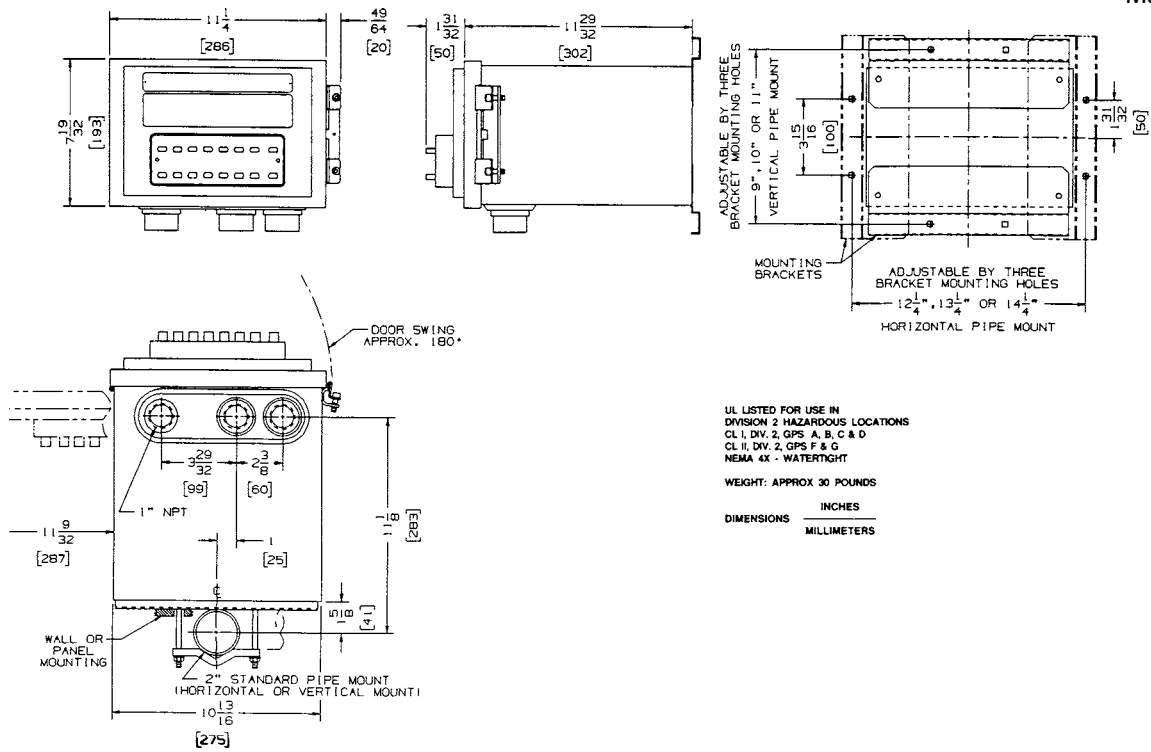


Figure 14 Dimensions Petrocount RMS Division 2, NEMA 4X Housing

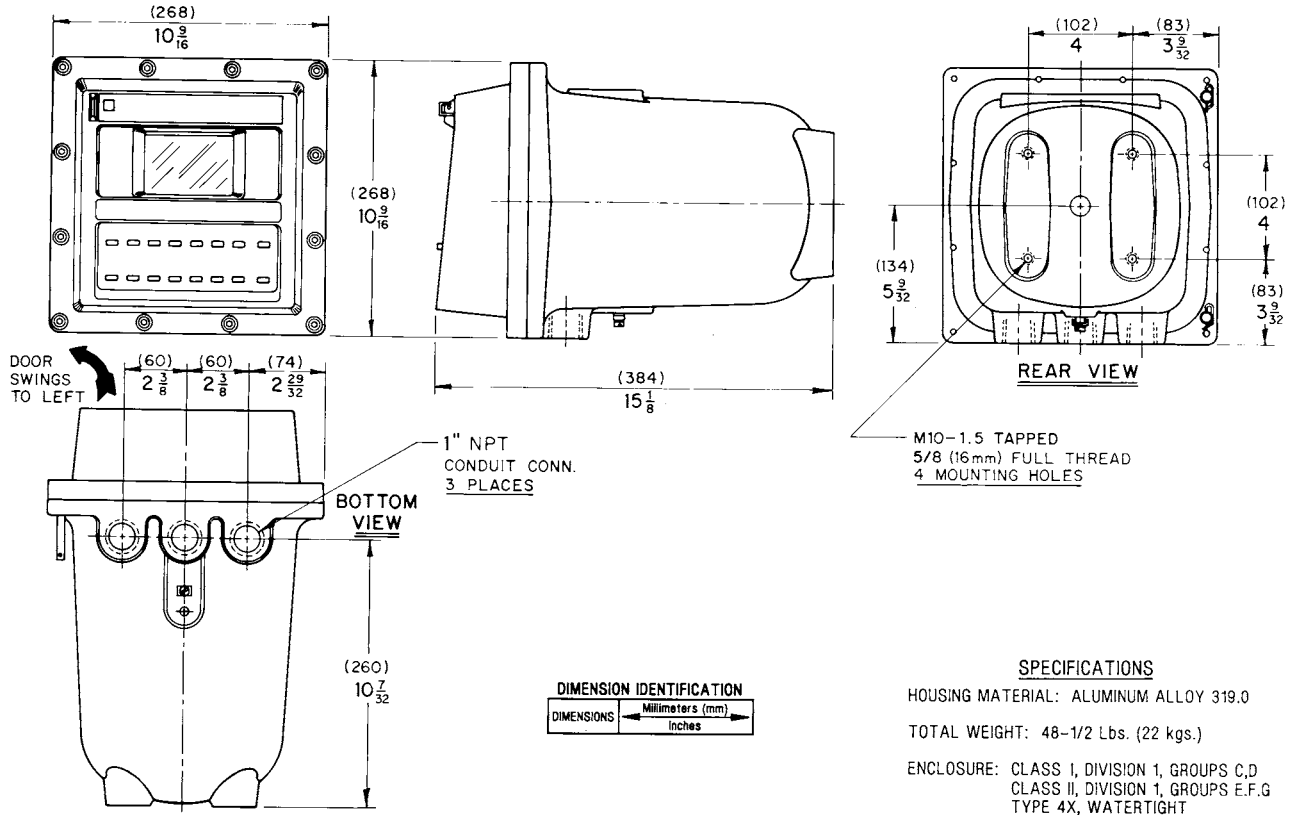
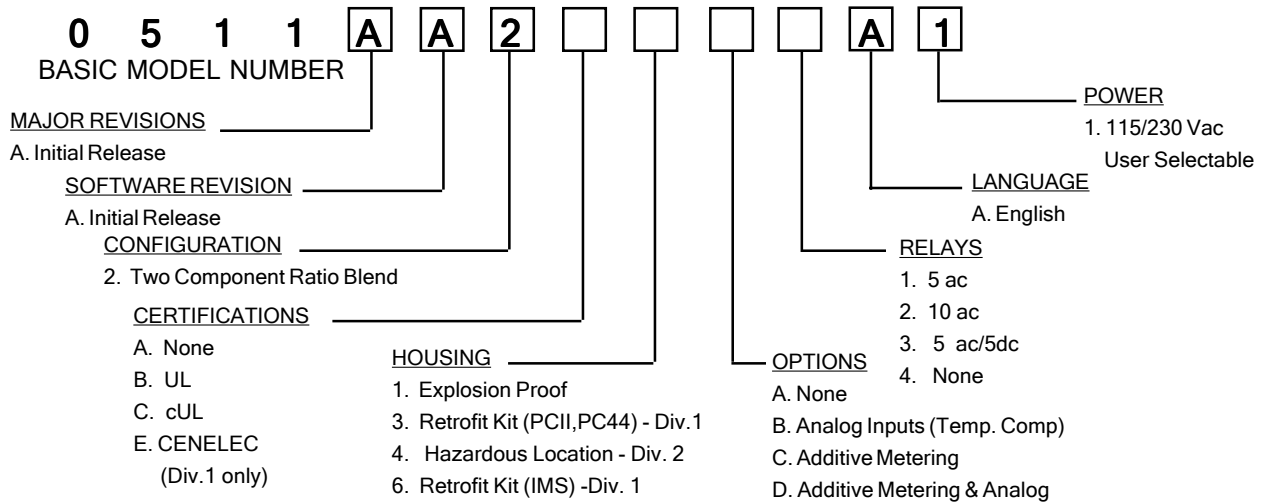
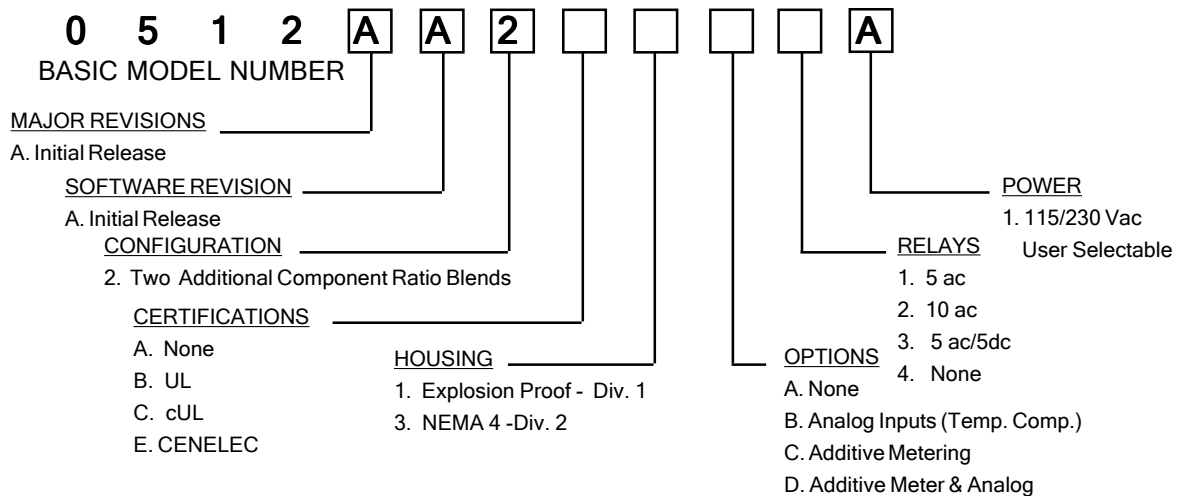


Figure 15 Dimensions Petrocount RMS Explosion Proof Housing

**Table 1 Main Control Unit Model Number Breakdown**



**Table 2 Satellite Control Unit Model Number Breakdown**



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