MODEL 2470
SOLARFLOW PLUS

ISO-5167V SOLARFLOW PLUS FOR

VOLUME AND MASS MEASUREMENT

APPLICATION MANUAL

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LC EPROM 8-2470-201
HHDT EPROM 8-2470-202

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DANIEL INDUSTRIES, INC.
MODEL 2470 SOLARFLOW PLUS
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DESCRIPTION

1.0 INTRODUCTION

The Model 2470 ISO-5167V SolarFlow Plus software applications have been designed to implement as many of the commonly required features of natural gas flow computers as possible. These applications have been designed to be compatible with existing Model 2470 support programs with minimal changes to those programs. This ISO-5167V software will calculate mass and volumetric flow rate using equations from ISO-5167:1991.

1.1 SCOPE OF THIS MANUAL

A SolarFlow Plus unit delivered from the factory is fitted with a erasable, programmable, read-only memory (EPROM) configured for the application for which the SolarFlow Plus is intended. The Hand Held Data Terminal (HHDT) provided with SolarFlow Plus is compatible with all Model 2470 applications specified. This manual provides specific information on a Model 2470 SolarFlow Plus system which can be configured for one of nine orifice meter applications. Basic reference information on the Model 2470 SolarFlow Plus system is provided in the System Reference Manual (Daniel Part Number 3-9000-451). The System Reference Manual includes sections on system hardware, software, installation, and operating procedures for both the SolarFlow Plus computer and the HHDT. The System Reference manual, together with this application manual, provides a complete information package for nine specific installations of the Model 2470 SolarFlow Plus system. This manual references the System Reference Manual whenever more detailed information is provided in that manual.

This manual includes sections on:

- Calculation modules for nine different orifice meter applications
- Field wiring connections for applicable inputs and outputs
- SETUP LOCATION menu parameters for the Hand Held Data Terminal (HHDT)
- SETUP UNIT menu parameters for the HHDT
- DISPLAY, CALIBRATE UNIT, ALARM and MONITOR menus for the HHDT
- Default user report listing
- Channel assignments for the unit
- Default data log list
- Default security codes
- Default alarm list

1.2 PRODUCT FEATURES

This ISO-5167V software has many commonly requested features resident in the firmware. All of these features are available regardless of the application for which the device is configured in the field. The primary features of the ISO-5167V Model 2470 SolarFlow Plus software are as follows:

- Serves as a 1, 2, or 3-run orifice meter application using ISO-5167:1991
- Supports AGA-8 according to the new standard (both detail and gross methods)
- Accepts a variety of transducer assignments, including support for stacked DP transmitters on primary meter runs and optional live gas quality inputs
- Allows the user access to all auxiliary analog inputs and their scales
- Has a digital gas chromatograph interface, but will default to the use of fixed gas quality values
- Supports tube switching for configurations with more than one meter run
- Performs valve positioning using an analog output to control station flow rate
- Offers an analog output proportional to station flow rate (user scalable)
- Provides two contact closure pulse outputs based on station volume

All of the application features are available in a single EPROM set which is supported by a single HHDT. The features that are common to all the applications are discussed generally. Features that apply to specific applications such as analog inputs, alarms, User Report lists, etc. will be located in the section dedicated to that particular application. A single channel list is available, containing the possible entries for all nine applications. If a particular application does not use a particular feature, that feature should be ignored.

1.3 ISO-5167V APPLICATIONS

The following ISO-5167V applications using flow rate equations from ISO-5167:1991 are included in this manual. The former closest equivalent applications are included for reference.

NEW APPLICATION	PREVIOUS ANALOGOUS APPLICATION	
SNGL ISO-5167V	AGA3 SNGL	8-2460-135/136
DUAL ISO-5167V	AGA3 DUAL	8-2460-135/136
TRIPL ISO-5167V	AGA3 TRIPLE TS	8-2460-159/160
	A TRIPLE TS	8-2460-222/223
DUAL 5167V COM	none - new application	
SSNGL ISO-5167V	AGA3 SSNGL	8-2460-135/136
SDUAL ISO-5167V	AGA3 SDUAL TS	8-2460-157/158
	A SDUAL TS	8-2460-220/221
STRIP ISO-5167V	none - new application	
DUAL 5167V SEPT	AGA3 DUAL SEPT	8-2460-127/128
BIDIR 5167V	none - new application	

All of these applications are implemented in a single EPROM set which is supported by a single HHDT. All have the features listed previously. Where a new application corresponds to a previous application, the transducer assignments are identical to existing ones to allow upgrading of current units in the field without rewiring the analog inputs. However most field upgrades will require the installation of a jumper to ground the discrete input for Channel 2 to prevent the new unit from using a live energy input. See the section on channel assignments.

The "DUAL 5167V COM" is a dual meter application with common pressure and temperature. The "STRIP ISO-5167V" is a stacked triple orifice application that supports measurement on three meter tubes with stacked differential pressure transmitters on the primary meter tube. Daniel Industries had no such previous application. The "BIDIR 5167V" is a bidirectional orifice meter which measures forward flow on the first meter, and reverse flow on the second meter. Station totals are for "net" (forward minus reverse) values.

1.4 CALCULATIONS

The calculation in the SolarFlow is divided into two distinct processes. These are as follows:

- Analog input sampling
- Rate and volume calculation cycle

These processes are usually operating autonomously without regard for the state of the other. Only when the rate calculation process is ready to begin a new cycle does it signal the sampling process that new inputs are required for a flow calculation. Upon receiving this signal, the sampling process transfers the inputs that have accumulated to the calculation process, and begins new accumulations.

1.4.1 ANALOG INPUT SAMPLING

Each 0.5 seconds all analog inputs are sampled. Six A/D conversions are done on each input in two groups of three successive samples. The time between these groups is about 10 milliseconds. The middle value in each group is kept and the average of the two values is considered the raw analog input value for that 0.5-second sample.

The samples are added to eight running sums which will be converted to average values and placed in SolarFlow Plus Channels 19 - 26 at the beginning of the next calculation cycle. These eight values are simple arithmetic averages of the inputs for the cycle. In addition to these eight averages, "flow time" averages are kept for six inputs to be used in each configured meter run (i.e. 18 averages total in a 3-run configuration). These six values are flow averages for differential pressure, measured static pressure in KPa, temperature, flowing density (regardless of source), heat value (regardless of source) and flow extension.

The flow extension is the square root of the differential pressure times the flowing density. A meter is considered to be flowing if the differential pressure for that meter is above the cut-off value. If no flow occurs for an entire calculation cycle, straight averages are kept for all inputs.

1.4.2 FLOW RATE EQUATIONS

The SolarFlow Plus calculates flow rate using equations from ISO-5167:1991. The resultant equation becomes:

$$Q_m = 0.0001264467\ \alpha\ \epsilon\ d^2 \sqrt{\Delta p * \rho_f}$$

$$Q_b = \frac{1000\ Q_m}{\rho_b}$$

where :

Q_m	=	mass flow rate in tons/hour
Q_b	=	volumetric flow rate in cubic meters/hour (M3/HR) at base conditions
d	=	orifice diameter at operating conditions (mm)
Δp	=	differential pressure (KPa)
ρ_f	=	mass density of the fluid (Kg/M3) at flowing conditions
α	=	flow coefficient = CD * EV
ε	=	expansion factor
ρ_b	=	mass density of the fluid at base conditions

Standard conditions = 101.325 KPa and 15^0 C

All density values are calculated in accordance with AGA Report No. 8, 1992. The operator may select the DETAIL (full analysis) or GROSS (short form) method for density calculation. For equations consult AGA Report No. 8.

All input gravity values used in the SolarFlow Plus are assumed to be for reference conditions of 101.325 KPa and 15° C.

The quantity,

$$\sqrt{\Delta p * \rho_f}$$

is stored as a separate entity in the SolarFlow Plus channel, FLOW EXTN, and is stored in the data log by default. This is in accordance with the COGM document on electronic flow meters.

1.4.3 RATE AND VOLUME CALCULATION

The SolarFlow Plus recalculates rates, volumes, and density on a continuous basis. The duration of this calculation cycle depends on the configuration chosen. The length of each cycle is fixed, to ensure that no calculation cycle crosses a log period boundary. The cycle periods for various configurations are:

NUMBER OF METERS	**AGA-8 DETAIL**	**AGA-8 GROSS (SHORT FORM)**
1	20 SEC	10 SEC
2	40 SEC	15 SEC
3	60 SEC	20 SEC

At the beginning of each cycle, the analog input averages accumulated during the preceding cycle are transferred to the SolarFlow Plus channels. Using these inputs, a new flow calculation is done for each configured meter run. The flowing density is calculated first, followed by the instantaneous flow rate. The rates and volumes are updated last. After all meters have been done, the station rates and volumes are updated.

1.4.4 LOGGING

The logging function is a part of the calculation cycle process. At the end of each cycle, the SolarFlow Plus updates all of the running averages for the log. For channels in the log definition designated as averages, "flow averages" are kept based on flowing conditions for the appropriate meter run. For channels which are associated with all runs (such as specific gravity or common temperature), averages are kept based on the flowing condition of the primary meter run. Straight time averages are kept for an item if the associated meter run is shut-in for the entire log period.

After updating the log averages, the SolarFlow Plus determines if it is time to make another data log entry and makes the new log if necessary.

1.5 GAS CHROMATOGRAPH INTERFACE

The SolarFlow Plus supports retrieval of gas composition and gas quality from the Model 2252 Danalyzer Gas Chromatograph Controller. SolarFlow Plus polls the chromatograph using the auxiliary serial port on the LD computer. Before polling the GC, the SolarFlow raises RTS (request to send) and waits to receive CTS (clear to send). If the CTS signal is not active, the SolarFlow will abort the polling cycle and retry at a later time. The simplest means of providing the CTS signal to the SolarFlow is to install a loopback jumper between RTS and CTS.

To enable the digital gas chromatograph interface, a jumper must be installed grounding digital input Channel 18. In addition to this, only two pieces of information must be programmed into the SolarFlow Plus. These are the MODBUS communication address of the chromatograph, and the chromatograph stream number of the data required.

The SolarFlow Plus initiates a poll of the GC about once every four minutes. If the poll is not successful, the poll will be retried every 20 seconds until the poll succeeds or attempts have been unsuccessful for over six minutes. After that time a communications error is declared and miscellaneous fault bit #4 is set. Each poll of the GC is made up of a series of MODBUS queries for chromatograph data. If any query fails, the poll sequence is aborted.

The first poll to the GC is for the time of the current analysis. This time stamp is saved for comparison later. Next, the current stream number is read. If this stream number does not match the user programmed stream number in the SolarFlow Plus, the poll sequence is ended to be re-tried in four minutes. Next a poll is issued for the HV content and specific gravity, followed by a poll for the 11 component values supported by the Model 2252. The final poll retrieves some chromatograph alarms and the analysis time stamp again. If the alarms denoted by MODBUS registers 3046 and 3047 are non-zero, the analysis time does not match that of the first poll, or certain values are out of range (SG>2.0, SG<0.4, N2>50, HV>75 or HV<10), the sequence is aborted and the GC analysis is discarded. Otherwise, the data is processed and saved in the SolarFlow Plus channels.

The data read from the GC and the associated MODBUS register numbers are:

C6+	7001
Propane	7002
I-Butane	7003
Butane	7004
Neo-Pentane	7005
I-Pentane	7006
Pentane	7007
Nitrogen	7008
Methane	7009
CO2	7010
Ethane	7011
Specific Gravity	7035 (Real Gas Relative Density)
HV Content	7033

If the retrieved value for Nitrogen exceeds 50 percent, the data is discarded and no further processing is done. The most common cause of a value greater than 50 percent for Nitrogen is the reassignment of MODBUS register numbers done when Neo-Pentane is deleted from the Model 2252 configuration. If this component must be deleted, a dummy component should be inserted in its place to preserve the register assignments as shown. These are the only checks the SolarFlow Plus does on the retrieved data before storing. The SolarFlow now applies reasonability checks of 0.4 - 2.0 on gravity and 10.0 - 75.0 MJ/M3 on heat valve.

Since the AGA-8 equations do not support Neo-Pentane or C6+ as a single component, the retrieved data is partially processed before storing as SolarFlow Plus channels. If Neo-Pentane is present, it is considered to be Iso-Pentane (which is the most chemically similar component supported by AGA-8) and added to that component's value. Any C6+ reported is separated into the following fractions:

Hexane	0.47466
Heptane	0.3534
Octane	0.17194

These fractions are the default values used by Model 2252 in the calculation of the reported value for HV content.

If the SolarFlow Plus has a prolonged communication error (greater than 6 minutes) with the Model 2252, miscellaneous fault bit number four is set.

1.6 TUBE SWITCHING

The double and triple run configurations in the SolarFlow Plus support meter tube switching based on differential pressure (DP). The primary run (meter run #1) is assumed to be always flowing, and the SolarFlow Plus will control the other run(s) by means of contact closure outputs connected to shutoff valves. Two differential pressure setpoints are used for each switched run. The differential open setpoint is the DP which must be observed on a meter run before the next run will be opened. The differential close setpoint is the DP level below which a run must fall before it is closed. (i.e. - Run #2 is opened when run #1 exceeds some predefined DP, and closed when DP #2 falls below a different level of predefined DP.)

The method of control for tube-switching in the SolarFlow Plus is based on the concept of a "control run". On initial startup, all tubes are opened and the last one becomes the control run. Each 0.5 seconds when the tube switching program runs, the DP on the control run is examined. If it exceeds the setpoint to open the next tube, that tube is opened and it becomes the new control run. If the DP falls below the close setpoint, the control run is closed, and the next lower run becomes the new control run.

In addition to the simplified algorithm above, the SolarFlow Plus implements three enhancements. First, the tube-switching feature may be enabled and disabled by an operator entry into the tube-switch enable channel. If the feature is disabled, the SolarFlow Plus completely ignores all other tube-switching parameters and performs no tube-switching control at all.

Second, a switching "dead-time" delay is used to prevent excessive valve wear. The dead-time is the time (in seconds) for which the DP must remain above or below the switching setpoint before the control will occur.

For example, if the delay is 30 seconds and DP on the control run rises above the open setpoint for only five seconds and then decreases again, no control will occur. The same delay applies to close setpoints as to open setpoints. This feature prevents brief "spikes" in flow rate from causing the tube-switching algorithm to oscillate. This dead-time delay feature is effectively disabled by using a delay of zero seconds.

The third refinement is that after any control order is issued by the tube-switching program, the algorithm is suspended for a user specified "valve travel time". This allows the valve time to respond before performing more tube switching controls.

1.7 VALVE POSITIONING

The SolarFlow Plus provides flow rate control based on rate or rate with pressure over-ride and also supports differential pressure over-range protection. The SolarFlow Plus controls the flow rate by means of an analog output connected to a control valve. For multiple run configurations, the controlled rate is the station flow rate. The valve positioning function can be configured to operate in various ways based on the value of the following configuration variables:

Valve positioning mode	0=none (disabled) 1=flow rate only 2=rate w/upstream pres over-ride 3=rate w/downstream pres over-ride
Flow setpoint	desired flow rate in M3/HR
Deadband	in % of setpoint
Small step	step for fine control
Large step	step for fast control
Fine control error limit	in % of setpoint
Over-ride pressure channel #	analog channel #
Over-ride pressure	in KPa
Differential pressure over-range limit	in KPa
Preset valve position	valve position for DP over-ride
Update time in seconds	valve positioning update time

If the function is disabled, or any analog input is under calibration, no control is done. To fix the valve position to a specific value, Channel 28 may be fixed to the desired value. This value will be maintained regardless of any configuration variables. If the function is enabled, and the valve position has not been fixed by the operator, the valve positioning function runs each half second after the analog inputs have been sampled.

1.7.1 DIFFERENTIAL OVER-RANGE PROTECTION

The differential pressure over-range protection feature is enabled by entering a non-zero value for the DP over-range limit. When enabled, this feature takes precedence over other valve positioning modes.

Each 0.5 seconds, the DP on the primary meter run is compared to the over-range limit. If the DP is below the over-range limit, valve positioning continues based on the selected mode. If the DP exceeds the limit, the valve position is set to the preset valve position, and the valve positioning function is aborted. Normal valve positioning resumes with the next analog sample cycle.

Certain combinations of parameters will cause the valve position to oscillate when this feature is enabled.

1.7.2 FLOW RATE CONTROL (VP MODE = 1)

SolarFlow Plus attempts to cause the measured flow rate to match a user entered flow rate setpoint. On initial startup the SolarFlow Plus sets the control output to 50 percent (3.0 volts). Each 0.5 seconds, a timer is incremented. If this timer is less than the programmed update time, the function is postponed for another cycle. After the update time has elapsed, the current flow rate is compared to the setpoint. If the difference (error) is greater than a fine control threshold, a large step is applied to the valve position. Otherwise, if the error is greater than a user programmed deadband, a small step is applied to the valve position. If the error does not exceed the deadband, no change is made to the valve position. The following example illustrates this.

Flow setpoint	500 M3/HR
Small step	0.1 %
Deadband	1 %
Large step	0.3 %
Fine control	
Error limit	5 %

If the observed flow rate is below 475 M3/HR, 0.3 percent will be added to the valve position (above 525, 0.3 percent will be subtracted). Otherwise, if the rate is below 495 M3/HR, 0.1 percent will be added to the valve position (above 505, 0.1 percent will be subtracted). If the observed flow rate is between 495 and 505 M3/HR, no control will be performed.

The flow rate for determining the error is estimated from the last system flow rate generated by the calculation cycle and the current flow extension. This estimation is:

$$Q_{vp} = Q_{sys} * Ext_{vp} / Ext_{sys}$$

where:

Q_{sys} Refers to system as contained in SolarFlow channels

Q_{vp} Refers to the most recent 0.5 second value generated during the analog input sampling process.

For multiple run configurations, the extensions in the equation above are simply the sum of the flow extensions for all meters.

1.7.3 FLOW RATE CONTROL WITH PRESSURE OVER-RIDE (VP MODE = 2 0R 3)

Each 0.5 seconds, the instantaneous value of the pressure over-ride channel (fixed value if the channel is fixed) is compared to the over-ride pressure value. If the pressure is less than the over-ride value, normal flow rate control continues. VP MODE = 2 or 3. If the pressure exceeds the over-ride value, the small step is added to the valve position for mode 2 or subtracted from the valve position for mode 3.

1.7.4 FLOW RATE OUTPUT

SolarFlow Plus provides an analog output proportional to station flow rate. This output is provided for use by external equipment which requires an analog indication of the measured flow rate. The flow rate output is updated once each calculation cycle. The user is free to rescale this output.

1.7.5 VOLUME PULSE OUTPUT

SolarFlow Plus provides two separate contact closure outputs based on station volume. Each has a volume per pulse channel and a pulse period channel for configuration. For each output, a volume accumulator holds the volume since the last pulse was output. When the accumulator exceeds the volume per pulse, this volume is subtracted from the accumulator, and a pulse is output. The accumulation is done once each calculation cycle.

1.8 ACCEPTING AND REJECTING CALIBRATION

The CALIBRATE UNIT menu provides for calibrating the SolarFlow Plus input circuitry to match the output of the transmitter for analog inputs to the SolarFlow Plus unit. The CALIBRATE UNIT menu has three selections: PRESSURES, TEMP, and OTHERS. Refer to section 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

SolarFlow Plus has a built-in reference table that correlates the 1-to-5 volt analog inputs to the measured variable. If the deviation between the "expected" (VALUE DISPLAYED) and the "actual" (user entered value) process variable is less than 10 percent, SolarFlow Plus will adjust its table to account for the deviation and accept the calibration. This is Case 1 in the following table. If the deviation between the "expected" and the "actual" process variable is greater than 10 percent, "OVER-DEVIATION CALIBRATION REJECTED" will be displayed. No EVENT log record will be made, and SolarFlow Plus will use the *prior* calibration data. This is Case 2.

Recheck the calibration. If calibration is still rejected, refer to the Problem Diagnoses in Section 7 of the System Reference Manual.

	VALUE TRANSMITTER	**VALUE DISPLAYED**	**HHDT DISPLAY**	**EVENT LOG ENTRY**
Case 1	100.5	100	CALIBRATION ACCEPTED	Entries for each calibration
Case 2	50	100	OVER-DEVIATION CALIBRATION REJECTED	(none)

NOTES:

- Zero scale = 0.0 (1.0 VDC analog input) and full scale = 100.0 in this case or (5.0 VDC analog input).
- The ACTUAL (XMTR) value shown in the table is for "FULL SET" during calibration.
- ACTUAL and VALUE DISPLAYED were identical for ZERO SET and LOW BIAS if present.
- ACTUAL differed from VALUE DISPLAYED by an amount proportional to the FULL SET error for MID SET if present.

1.9 LOG DEFINE PROMPT

The LOG DEFINE prompt in the INPUTS submenu is used to add, delete, or modify items contained in the Data Log list. A six-character alphanumeric entry defines the item to be logged. For example, the six characters "020A61" are defined as follows by the characters ChTLD:

Ch: Channel number, which is 020 in the example 020A61
T: Type of log, which is A in the example 020A61.
T can be:
A for average over log interval
S for snapshot
Z for snapshot and zero at logging time.
L: Number of digits to be logged, which is 6 in the example 020A61; possible values are 2, 4, 6, 8.
D: Number of decimal places to be displayed, which is 1 in the example 020A61.

Therefore, "020A61" is decoded to mean that the item to be logged is an input from Channel 20 (Metr Pres), with a value averaged over the logged interval. The item has six digits with one number after the decimal point.

1.10 RADIO COMMUNICATION

This software may be used for radio communication only with Daniel PC software that supports "Radio Packetized Logon". The "Radio Packetized Logon" is active in SolarFlow Plus whenever a radio interface is installed, no local HHDT cable is plugged in, and RTS DELAY is set to some non-zero value.

1.11 USER LOGON EVENT

This application generates a "User logged on" record in the Event log only if the user performed an action (e.g. changed a measurement parameter, etc.) which generates another event. In other words, no event log entry is made when a user logs on and just reads current values. The number of events in active memory has been increased to 150 before the older events are discarded.

1.12 HIGH SPEED CHANNEL READS

This application supports high speed channel reads with DSI protocol.

1.13 SLIDE SWITCH SETTINGS

The main printed circuit (PC) Board of a SolarFlow Plus unit has several sets of slide switches that are factory set for the application installed in the unit. Figure 1 illustrates the locations *only* of the slide switches on the older PC board. This Application Manual shows the slide switch settings for this application. Figure 2 illustrates the locations *only* of the slide switch settings of the newer PC board. The PCA number on the illustration specifies the assembly of this particular board. ***If you have a newer PC board*** *(3-2470-008), the switch reference designators are different, see section 1.13.1.* Note that the slide switches use SW- reference designators on the newer PCB. For a full discussion of the slide switch settings or if the application is changed, refer to the System Reference Manual. Check your installation switch settings with the following tables.

SLIDE SWITCH SETTINGS FOR PC BOARD 3-2470-000
(Refer to Figure 1.)

Switch Set	Switch Position	Configuration in ON position
S1-1	OFF	PD meter No. 2 active
S1-2	OFF	Turbine meter No. 2 active
S3-1	OFF	PD meter active
S3-2	OFF	Turbine meter active
S2-1	ON	Always ON
S2-2	N/A	Reserved for future use
S2-3	N/A	Reserved for future use
S2-4	ON	For single DP transmitter using orifice meters
S2-4	OFF	For stacked DP transmitters using orifice meters

Switches S2-5 through S2-8 should be ON.

S4-1	ON	Relay K1 activated by Channel 5
S4-2	OFF	Relay K1 activated by Channel 7
S4-3	ON	Relay K2 activated by Channel 6
S4-3	OFF	Relay K2 activated by Channel 8

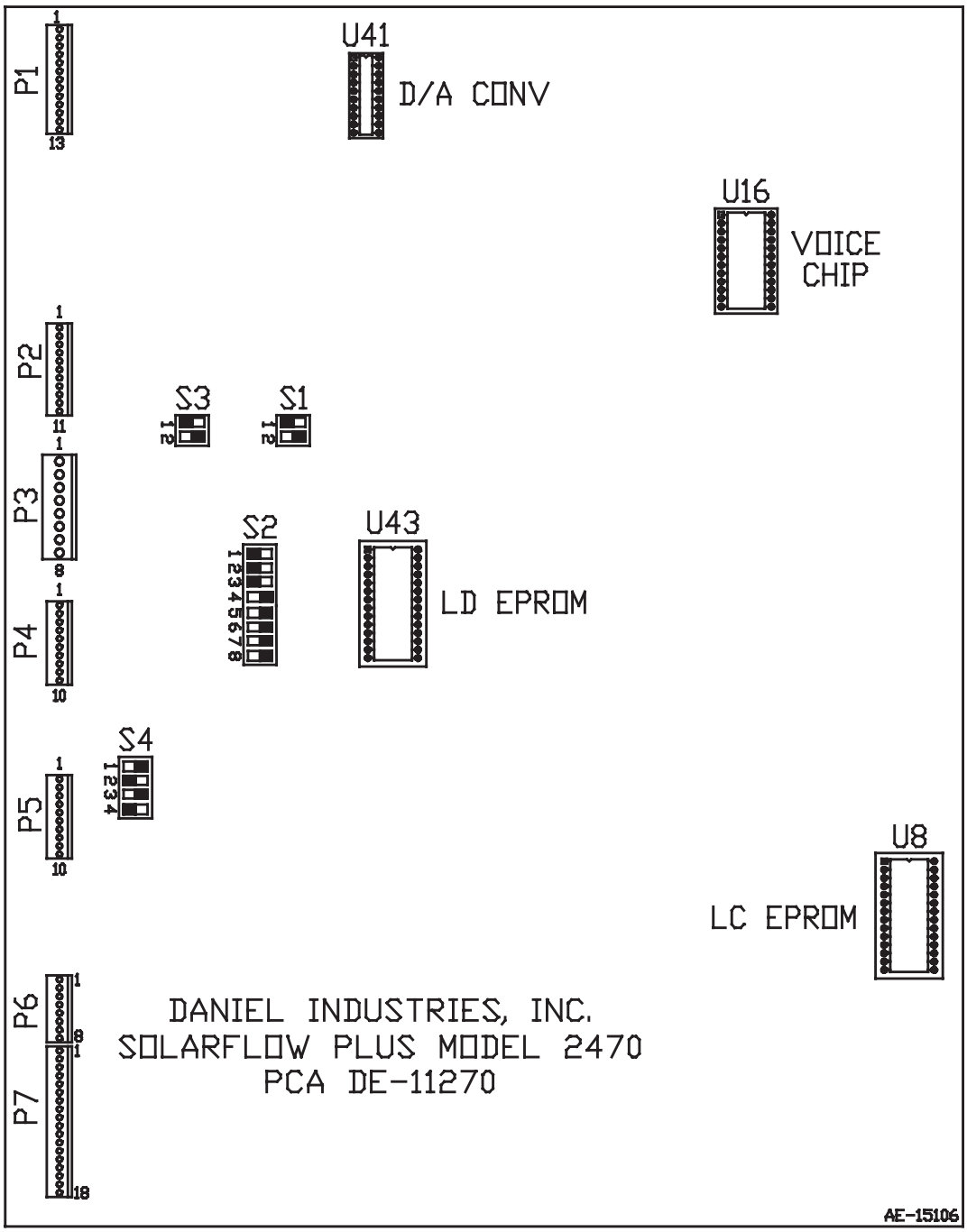

Figure 1. Model 2470 Slide Switch Locations
(PC Board Assembly Part No. 3-2470-000)

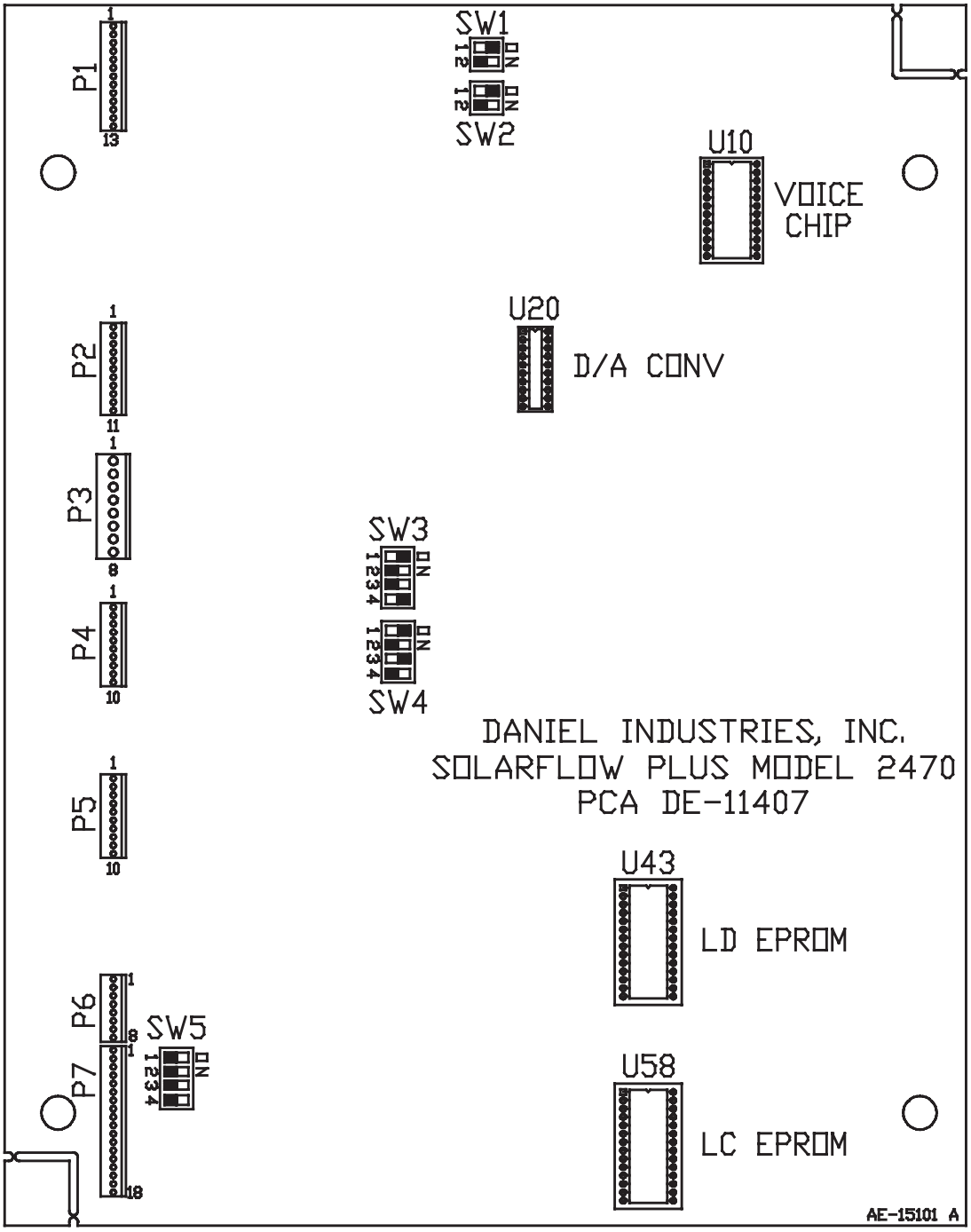

Figure 2. Model 2470 Slide Switch Locations
(PC Board Assembly Part No. 3-2470-008)

1.13.1 CHANGED SLIDE SWITCH SETTINGS FOR PC BOARD 3-2470-008

These slide switch settings are for newer PC Board 3-2470-008. These settings will be set at the factory when the application is known. Figure 2 illustrates the locations *only* of the slide switch settings of the newer PC board. Note that the slide switches use SW- reference designators on this newer PCB. For a full discussion of the slide switch settings or if the application is changed, refer to the System Reference Manual. Check your installation switch settings with the following tables.

SLIDE SWITCH SETTINGS FOR PC BOARD 3-2470-008
(Refer to Figure 2.)

Switch Set	Switch Position	Configuration in ON position
SW1-1	N/A	Reserved
SW1-2	N/A	Reserved
SW2-1	N/A	Reserved
SW2-2	N/A	Reserved
SW3-1	ON	Always ON
SW3-2	N/A	Reserved for future use
SW3-3	N/A	Reserved for future use
SW3-4	ON	For single DP transmitter using orifice meters
SW3-4	OFF	For stacked DP transmitters using orifice meters
SW4-1	ON	Relay K1 activated by Channel 5
SW4-2	OFF	Relay K1 activated by Channel 7
SW4-3	ON	Relay K2 activated by Channel 6
SW4-4	OFF	Relay K2 activated by Channel 8

1.14 ENHANCED SOFTWARE MISCELLANEOUS CONDITION BITS

The Misc. column of a data log printout indicates system conditions that occurred or were present during the log interval by replacing a dot with a number that identifies a specified condition. These numbers represent a designated system condition regardless of the ALARM setup in the SolarFlow Plus menu. These condition bits cannot be activated, deactivated, or acknowledged. They will appear on the SolarFlow Plus data log. The Channel 30 system alarm (SYS ERROR) equals these miscellaneous bits converted to decimal representation if they occur. An exception is that a cold start will not cause a SYS ERROR occurrence caused only by a cold start. Note that normally Channel 30 is 0.0. The data log will show the Misc. dots as follows:

Date	Time	METR TEMP	METR PRES	DIFF PRES	TODAY VOL	U-Range	O-Range	Misc.
MM/DD/YY	HH:MM	xxxx	xxxx	xxxx	xxxx	.....	.....	.....

The enhanced version of these miscellaneous bits is as follows:

Dot No.	System Conditions	Weight in CH 30
8	System Failure	1.0
7	Cold Start	2.0
6	Warm Start	4.0
5	Designates Daily Log	8.0
4	Chromatograph Communications Failure	16.0
3	Reserved	32.0
2	Floating Point Error	64.0
1	Reserved	128.0

Any condition that occurs will be shown in Channel 30 as a decimal number. For example if dot No. 2 (Floating Point Error) had occurred, the binary number would be converted to decimal 64.0. This number would be < > 0.0 and it would be seen in Channel 30 (SYS ERROR) as the decimal number. Counting the dots from left to right, it would show in the data log as decimal 2 in the second position under Misc.

ISO-5167V SOLARFLOW PLUS CHANNEL ASSIGNMENTS

2.0 SOLARFLOW PLUS CHANNEL ASSIGNMENTS

The ISO-5167V SolarFlow Plus software features a comprehensive set of channels which should satisfy all of the expected applications with some room for future growth. It is expected that these channels will be capable of handling all the needs of ISO-5167:1991. The ISO-5167V SolarFlow Plus supports 240 channels. The first 28 channels have the same special meaning as in the past. The remaining channels are the calculation channels which contain all rates, volumes, calculated results and configuration entries. The calculation channels begin with the "system" channels which apply to the whole unit without regard for a specific meter tube, followed by three groups of channels for information specific to each of the three meter tubes. Most of the supported applications do not use all of the channels defined. The channels not used by a particular configuration are reserved if that application has been selected, and are not available for other purposes.

All nine applications have identical channel assignments except for the analog inputs.

The sections devoted to a particular application will contain the channels and other items specific to a particular application.

If LV DENSITY and/or LV ENERGY channels are not in use, that unused channel becomes available as an auxiliary. However, the HHDT will still describe the channel as density or energy.

The following list is a comprehensive channel list for all nine applications with the exception of the channels defined by a particular application.

2.1 CHANNEL ONE THROUGH 18 ASSIGNMENTS

Assignments for the multiple usage application Channels one through 18 are tabulated as follows.

CH	LABEL	IN/ OUT	0-LABEL	1-LABEL	DEFAULT	DESCRIP-TION
001*	LV DENSITY	INP	NO	YES	NO	Live density in use
002*	LV ENERGY	INP	NO	YES	NO	Live energy in use
003 through 004 are reserved for later use						
005	VP 1	OUT	OFF	ON	OFF	Volume pulse output 1
006	VP 2	OUT	OFF	ON	OFF	Volume pulse output 2
007	OPEN 2	OUT	ON	OFF	ON	Tube switching control
008	CLOSE 2	OUT	OFF	ON	OFF	Tube switching control
009 through 010 reserved for later use						
011	OPEN 3	OUT	ON	OFF	ON	Tube switching control
012	CLOSE 3	OUT	OFF	ON	OFF	Tube switching control
013 through 017 reserved for later use						

CH	LABEL	IN/ OUT	0-LABEL	1-LABEL	DEFAULT	DESCRIP-TION
018	CHROM		EN-ABLE	DIS-ABLE	DISABLE	Jumper installed enables GC

* LV DENSITY for channel 001 indicates pin 51 not jumpered to pin 60. LV ENERGY for channel 002 indicates pin 52 not jumpered to pin 61.

2.2 CHANNEL 19 THROUGH 240 ASSIGNMENTS

Assignments for the ISO-5167V SolarFlow Plus software Channels 19 through 28 are shown here for reference only. The column labeled DP in the table indicates the number of digits displayed past the decimal point. Channel assignments 20 through 26 will change depending on the requirements for the individual application. Refer to the section specifying the particular assignments for your desired application for the actual assignments.

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
019	BATTERY	VOLTS	2	0.00	Scale 3.2 -16
Channels 20-26 as per applications					
027	FLW RT OUT	M3/HR	0	0.0	Analog Flow Rate
028	VALVE POS	%	1	50.0	Current Valve Position
029	VERSION		1	2.0	Software version
030	SYS ERROR		0	0	System alarm
031	RESERVED		0	0	
032	COMP DPRES	KPa	1	0.0	Composite DP if stacked
033	ATMS PRES	KPa	3	101.325	Atmospheric pressure
034	PRES BASE	KPa	3	101.325	Pressure base
035	TEMP BASE	Deg C	1	15.0	Temperature base
036	ORIF MTRL	(None)	0	1	Orifice material 0=carbon steel 1=stainless steel 2=monel
037	PIPE MTRL	(None)	0	0	Pipe material 0=carbon steel 1=stainless steel 2=monel
038	TREF ORIF	Deg C	1	20.0	Reference temp of orifice plate
039	TREF PIPE	Deg C	1	20.0	Reference temp of pipe

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
040	VISCOSITY	CP	6	0.010268	Fluid viscosity
041	SPEC HEAT		2	1.30	Specific heat ratio
042	SG SELECT		0	1	Input Specific Gravity 0=ideal, 1=real
043	AGA8 MTHD		0	0	AGA-8 Method 0=detail Non-zero=GR,CO2,N2
044	ZS		6	1.000000	Standard density
045	DENSITY-B	KG/M3	4	0.7500	Base density
046	MOL WT		4	16.8000	Calculated by AGA-8
047	B		6	0.000000	AGA-8 2nd virial coeff.
048	C		6	0.000000	AGA-8 3rd virial coeff.
049	D		6	0.000000	AGA-8 reduced density
050	K		6	0.000000	AGA-8 mixture size parameter
051	SPEC GRAV	(None)	4	0.6000	Current specific gravity
052	HEAT VALUE	MJ/M3	3	37.000	Current heat value
053	METHANE	MOL%	3	95.000	Methane MOL%
054	N2	MOL%	3	0.000	Nitrogen MOL%
055	CO2	MOL%	3	0.000	Carbon dioxide MOL%
056	ETHANE	MOL%	3	5.000	Ethane MOL%
057	PROPANE	MOL%	3	0.000	Propane MOL%
058	H2O	MOL%	3	0.000	Water MOL%
059	H2S	MOL%	3	0.000	Hydogen sulphide MOL%
060	HYDROGEN	MOL%	3	0.000	Hydrogen MOL%

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
061	CO	MOL%	3	0.000	Carbon Monoxide MOL%
062	OXYGEN	MOL%	3	0.000	Oxygen MOL%
063	I-BUTANE	MOL%	3	0.000	I-butane MOL%
064	BUTANE	MOL%	3	0.000	Butane MOL%
065	I-PENTANE	MOL%	3	0.000	I-pentane MOL%
066	PENTANE	MOL%	3	0.000	Pentane MOL%
067	HEXANE	MOL%	3	0.000	Hexane MOL%
068	HEPTANE	MOL%	3	0.000	Heptane MOL%
069	OCTANE	MOL%	3	0.000	Octane MOL%
070	NONANE	MOL%	3	0.000	Nonane MOL%
071	DECANE	MOL%	3	0.000	Decane MOL%
072	HELIUM	MOL%	3	0.000	Helium MOL%
073	ARGON	MOL%	3	0.000	Argon MOL%
074	CHROM ADDR	(None)	0	1	Chrom address
075	CHROM STRM	(None)	0	1	Chrom stream No.
076	VPP 1	M3	0	1000	Volume per pulse 1
077	PP 1	SEC	0	1	Pulse period 1
078	VPP 2	M3	0	1000	Volume per pulse 2
079	PP2	SEC	0	1	pulse period 2
080-081 RESERVED					
082	TS ENABLE	(None)	0	0	0=disable, 1=enable
083	OPEN 2 SP	KPa	2	25.00	Valve 2 DP open
084	CLOSE 2 SP	KPa	2	5.00	Valve 2 DP close

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
085	OPEN 3 SP	KPa	2	25.00	Valve 3 DP open
086	CLOSE 3 SP	KPa	2	5.00	Valve 3 DP close
087	TS DELAY	SEC	0	30	Tube switching delay time
088	VALVE TIME	SEC	0	30	Valve travel time
089-090 RESERVED					
091	VP MODE	(None)	0	0	Valve positioning option 0=disabled 2=rate w/upstrm pres ovrd 3=rate w/dnstrm pres ovrd
092	FLW SETPNT	M3/HR	0	0	Flow rate setpoint
093	DEADBAND	%	1	2.0	Control deadband %
094	SMALL STEP	%	2	0.05	Fine valve step %
095	LARGE STEP	%	1	0.5	Coarse valve step %
096	FINE CNTRL	%	0	5	Error limit control %
097	PRES CHAN#		0	20	Ch. No. for press ovrd
098	OVRD PRESS	KPa	0	0	Press over-ride limit
099	DP LIMIT	KPa	0	0	DP over-ride limit 0=disabled
100	PRESET POS	%	0	100	Valve position for DP ovrd
101	UPDATE TIM	SEC	0	10	Valve position update time
102-119 RESERVED					
120	ORIF DIAM1	MM	1	100.0	Meter 1 orifice diameter
121	PIPE DIAM1	MM	1	200.0	Meter 1 pipe diameter

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
122	TAP LCTN 1	(None)	0	0	Tap location 0=downstream 1=upstream
123	TAP TYPE 1	(None)	0	0	Tap type 0=flange tap 1=corner tap 2=D, D2 taps
124	ZFLOW LIM1	KPa	2	0.10	Low flow cutoff
125	CORR OD1	MM	1	0	Temp corrected orifice diameter 1
126	CORR PD1	MM	1	0	Temp corrected pipe
127	CORR BETA1	(None)	5	0.00000	Temp corrected Beta ratio
128	EV1	(None)	5	1.00000	Velocity of approach factor
129	CD 1	(None)	6	0.600000	Coefficient of discharge
130	DENSITY-F1	KG/M3	3	0.750	Flowing density
131	Y FCTR 1	(None)	6	1.000000	Expansion factor
132	FLW EXTN 1	(None)	3	0.000	sqrt($\Delta p * \rho f$)
133	FLW TIME 1	MIN	2	0.00	Flow time
134	FLOW RATE1	M3/HR	0	0	Hourly flow rate
135	FLOW RATE1	M3/DAY	0	0	Daily flow rate
136	LOG VOL 1	M3	0	0	Logged accumulated volume
137	TODAY VOL1	M3	0	0	Daily accumulated volume
138	YSDAY VOL1	M3	0	0	Ysday’s accumulated volume

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
139	TOT VOL 1	M3	0	0	Total accumulated volume (Rolls over @ 10,000,000)
140	ERATE 1	GJ/HR	1	0.0	Energy flow rate
141	LOG ENRGY1	GJ	1	0.0	Logged accumulated energy
142	TDY ENRGY1	GJ	1	0.0	Today's accumulated energy
143	YSY ENRGY1	GJ	1	0.0	Ysday's accumulated energy
144	TOT ENRGY1	GJ	1	0.0	Total accumulated energy (Rolls over @ 10,000,000)
145	FLOW RATE1	TON/H	2	0.00	Mass flow rate
146	LOG VOL 1	TONS	2	0.00	Logged accumulated mass
147	TODAY VOL1	TONS	2	0.00	Daily accumulated mass
148	YSDAY VOL1	TONS	2	0.00	Ysday's accumulated mass
149	TOT VOL 1	TONS	2	0.00	Total accumulated mass
150	ORIF DIAM2	MM	1	100.0	Meter 2 orifice diameter
151	PIPE DIAM2	MM	1	200.0	Meter 2 pipe diameter
152	TAP LCTN 2	(None)	0	0	Tap location 0=downstream 1=upstream
153	TAP TYPE 2	(None)	0	0	Tap type 0=Flange taps 1=corner taps 2=D, D/2 taps
154	ZFLOW LIM2	KPa	2	0.10	Low flow cutoff

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
155	CORR OD2	MM	1	0.0	Temp corrected orifice diameter 2
156	CORR PD2	MM	1	0.0	Temp corrected pipe diameter 2
157	CORR BETA2	(None)	5	0.00000	Temp corrected Beta ratio
158	EV2	(None)	5	1.00000	Velocity of approach factor
159	CD 2	(None)	6	0.600000	Coefficient of discharge
160	DENSITY-F2	KG/M3	3	0.750	Flowing density
161	Y FCTR 2	(None)	6	1.000000	Expansion Factor
162	FLW EXTN 2	(None)	3	0.000	sqrt($\Delta p * \rho f$)
163	FLW TIME 2	MIN	2	0.00	Flow time tube 2
164	FLOW RATE2	M3/HR	0	0	Hourly flow rate
165	FLOW RATE2	M3/DAY	0	0	Daily flow rate
166	LOG VOL 2	M3	0	0	Logged accumulated volume
167	TODAY VOL2	M3	0	0	Today’s accumulated volume
168	YSDAY VOL2	M3	0	0	Ysday’s accumulated volume
169	TOT VOL 2	M3	0	0	Total accumulated volume (Rolls over @ 10,000,000)
170	ERATE 2	GJ/HR	1	0.0	Energy flow rate
171	LOG ENRGY2	GJ	1	0.0	Logged accumulated energy
172	TDY ENRGY2	GJ	1	0.0	Today’s accumulated energy

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
173	YSY ENRGY2	GJ	1	0.0	Ysday's accumulated energy
174	TOT ENRGY2	GJ	1	0.0	Total accumulated energy (Rolls over @ 10,000,000)
175	FLOW RATE2	TON/H	2	0.00	Mass flow rate
176	LOG VOL 2	TONS	2	0.00	Logged accumulated mass
177	TODAY VOL2	TONS	2	0.00	Daily accumulated mass
178	YSDAY VOL2	TONS	2	0.00	Ysday's accumulated mass
179	TOT VOL 2	TONS	2	0.00	Total accumulated mass
180	ORIF DIAM3	MM	1	100.0	Meter 3 orifice diameter
181	PIPE DIAM3	MM	1	200.0	Meter 3 pipe diameter
182	TAP LCTN 3	(None)	0	0	Tap location 0=downstream 1=upstream
183	TAP TYPE 3	(None)	0	0	Tap Type 0=flange tap 1=corner tap 2=D, D/2 taps
184	ZFLOW LIM3	KPa	2	0.10	Low flow cutoff
185	CORR OD3	MM	1	0.0	Temp corrected orifice diameter 3
186	CORR PD3	MM	1	0.0	Temp corrected pipe diameter 3
187	CORR BETA3	(None)	5	0.00000	Temp corrected Beta ratio
188	EV3	(None)	5	1.00000	Velocity of approach factor

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
189	CD 3	(None)	6	0.600000	Coefficient of discharge
190	DENSITY-F3	KG/M3	3	0.75	Flowing density
191	Y FCTR 3	(None)	6	1.000000	Expansion factor
192	FLW EXTN 3	(None)	3	0.000	sqrt($\Delta p * \rho f$)
193	FLW TIME 3	MIN	2	0.00	Flow time tube 3
194	FLOW RATE3	M3/HR	0	0	Hourly flow rate tube 3
195	FLOW RATE3	M3/DAY	0	0	Daily flow rate tube 3
196	LOG VOL 3	M3	0	0	Logged accumulated volume
197	TODAY VOL3	M3	0	0	Daily accumulated volume
198	YSDAY VOL3	M3	0	0	Ysday's accumulated volume
199	TOT VOL 3	M3	0	0	Total accumulated volume (Rolls over @ 10,000,000)
200	ERATE 3	GJ/HR	1	0.0	Energy flow rate/hour
201	LOG ENRGY3	GJ	1	0.0	Logged accumulated energy
202	TDY ENRGY3	GJ	1	0.0	Today's accumulated energy
203	YSY ENRGY3	GJ	1	0.0	Ysday's accumulated energy
204	TOT ENRGY3	GJ	1	0.0	Total accumulated energy (Rolls over @ 10,000,000)

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
205	FLOW RATE3	TON/H	2	0.00	Mass flow rate
206	LOG VOL 3	TONS	2	0.00	Logged accumulated mass
607	TODAY VOL3	TONS	2	0.00	Daily accumulated mass
208	YSDAY VOL3	TONS	2	0.00	Ysday's accumulated mass
209	TOT VOL 3	TONS	2	0.00	Total accumulated mass
210	STN FLW RT	M3/HR	0	0	Flow rate per hour
211	STN FLW RT	M3/DAY	0	0	Flow rate per day
212	ST LOG VOL	M3	0	0	Station logged volume
213	ST TDY VOL	M3	0	0	Station today's volume
214	YSDAY VOL	M3	0	0	Station ysday's volume
215	ST TOT VOL	M3	0	0	Station total volume (Rolls over @ 10,000,000)
216	STN ERATE	GJ/HR	1	0.0	Station flow rate
217	LOG ENERGY	GJ	1	0.0	Station logged energy
218	TDY ST ENG	GJ	1	0.0	Station today's energy
219	YSY ST ENG	GJ	1	0.0	Station ysday's energy
220	TOT ENERGY	GJ	1	0.0	* Station total energy
221	STN FLW RT	TON/H	2	0.00	Station mass flow rate
222	ST LOG VOL	TONS	2	0.00	Station logged mass
223	ST TDY VOL	TONS	2	0.00	Station today's mass
224	YSDAY VOL	TONS	2	0.00	Station ysday's mass
225	ST TOT VOL	TONS	2	0.00	Station total mass*
226 - 240 Reserved					

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
*	All totals roll over at 10,000,000 so adjust your units accordingly.				

ISO - 5167V SINGLE ORIFICE APPLICATION

3.0 SINGLE ORIFICE APPLICATION

Section 3 covers the individual requirements for the ISO-5167V single orifice application (SNGL ISO-5167V) configured to calculate mass and volumetric flow rate using equations from ISO-5167:1991. The single orifice application supports measurement on a single meter tube. Optional capabilities such as valve positioning, chromatograph inputs, etc. are listed as part of the setup. If you do not need some of these capabilities, they may be skipped when entering the setup parameters with the Handheld Data Terminal (HHDT). Channels 1 and 2 are digital inputs which indicate whether an analog input is used for live density and energy respectively. To select fixed values, these inputs should be jumpered to ground; for live values, the inputs should be left open. Analog inputs use Channels 19 through 26. Any unused analog input should be jumpered to ground.

When the SolarFlow Plus is configured for a new application, all channels are set to default values, and the Alarm definitions, Log definition, User Report list, and Analog Input channels are set to the values corresponding to the configuration chosen. The event log remains intact, but the data log is emptied.

3.1 FIELD WIRING CONNECTIONS

Before exchanging your EPROM set for working installations, make sure that all previous data is recorded as needed. Make sure that your slide switch settings are set in accordance with the information in section 1.13. No changes should be required unless the previously used application has been significantly different. Configurations for this application include the static pressure and DP transmitter(s) associated with meter 1 installed within the Model 2470 enclosure with all other transmitters installed externally, or with *all* transmitters installed externally.

The wiring configuration for the single orifice analog inputs is shown in this section.

A field wiring diagram is provided in the Model 2470 System Reference Manual. The following information furnishes necessary details for wiring both internal and external transmitters.

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
20	INTERNAL, static pressure (factory installed)	White (Blue*) Green (Black*) Black (Red*)	23 26 25	Signal in + Analog ground 8 to 10 VDC
*	SolarFlow Plus units fitted with Statham 36PG series static pressure transmitters are wired with the blue, black, and red wires.			
		or		
20	EXTERNAL, static pressure (to be installed by user)	Blue Black Red Shield	23 26 25 24	Signal in + Analog ground 8 to 10 VDC Earth ground
21	None, Jumper pin 27 to 30	Black Black	27 30	Signal in + Analog ground
22	EXTERNAL, temperature (to be installed by user)	Blue Black Red Gray	31 34 33 32	Signal in + Analog ground 8 to 10 VDC Earth ground
23	INTERNAL, differential pressure (DP) (factory installed)	Violet Black Gray	35 38 37	Signal in + Analog ground 8 to 10 VDC
		or		
23	EXTERNAL, differential (DP) (to be installed by user)	Blue Black Red Shield	35 38 37 36	Signal in + Analog ground 8 to 10 VDC Earth ground
24	None, jumper pin 39 to 42	Black Black	39 42	Signal in + Analog ground
25	EXTERNAL, LV DENSITY(1) (2) (to be installed by user)		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
26	EXTERNAL, LV ENERGY (to be installed by user)		47 50 49 48	Signal in + Analog ground 8 to 10 VDC Earth ground

NOTES:

(1) Since fixed values are normally desired for density and energy, digital input channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 59 and 60, 52 and 61 on the rear termination board. The fixed values for the heat value and specific gravity are entered in the GAS DATA submenu of the SETUP UNIT menu by keying in the desired value. Refer to the System Wiring Diagram.

(2) Wire for connecting the external transmitter inputs is user-supplied.

3.2 STATUS SIGNAL CONNECTIONS

This application supports one status input that is activated by a dry contact closure between the status input pin number and common.

3.2.1 INPUTS

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
1	Live or fixed density	LV DENSITY	60 59 (GND)	Open, means use live density Shorted, means calculate density
2	Live or fixed energy	LV ENERGY	61 52 (GND)	Open, means use live energy Shorted, means use fixed energy
18	Chromatograph option	CHROM	68 58 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

	CH 1	CH 2	CH 18
Live SG and HV	No jumper	No jumper	No jumper
Fixed SG and HV	Jumper/GND	Jumper/GND	No jumper
Serial Chromatograph	Jumper/GND	Jumper/GND	Jumper/GND

Note that serial chromatograph inputs require that SG and HV be jumpered to ground as if fixed.

3.2.2 OUTPUTS

NOTE: All output signals from a SolarFlow Plus unit installed in a hazardous location must be isolated by means of intrinsic safety barriers.

This application has two form-A relays (mounted on the SolarFlow Plus PC board) that provide digital outputs for corrected station volume on Channels 5 and 6. The volume per pulse and the pulse period of the relays may be changed using the HHDT. Prompts for changing the relay volume per pulse (VPP1 and VPP2) and pulse period (PP1 and PP2) are included in the discussion of the CONTROL submenu of the SETUP UNIT menu, section 3.4.7.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	15 16	Form-A relay Common
6	Volume pulse output 2	VP2	17 18	Form-A relay Common

TTL level outputs for Channels 5 and 6 are available at the termination board pin numbers shown in the following table.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	78 76	TTL output Common
6	Volume pulse output 2	VP2	79 70	TTL output Common

3.2.3 ANALOG OUTPUT CONNECTIONS

This application provides two 1-5 VDC analog outputs.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
27	Flow rate output	FLW RT OUT	3 4	Analog output 1 Ground
28	Valve positioning	VALVE POS	1 2	Analog output 2 Ground

3.2.4 CHROMATOGRAPH INTER-CONNECTIONS

For more detail in wiring the Model 2252 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 systems Reference Manual.

MODEL 2252	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out Serial in Ground	102 103 106	DI in DI out DI ground

3.3 SETUP LOCATION MENU

The SolarFlow Plus operating parameters for the ISO-5167V single orifice meter application that can be changed in the SETUP LOCATION menu are shown in the following table described by the HHDT prompt for the parameter, the factory-installed default value, and a blank space for entering the desired value if different from the factory default. Additional information on the SETUP LOCATION menu is provided in section 5.10.1 of the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT	DESIRED
LOC NAME	BLANK LOCATION	_____
LOC ID	0	_____
DATE	010180 MMDDYY	_____
WEEK DAY	1 (1-7)	_____
TIME	0000 HHMM	_____
SEC CODE(1)	120	_____
USER REP(2)	****	_____
PCOMM RATE(3)	300 BPS	_____
RTS DELAY(4)	0 1/100s	_____

NOTES:

(1) Refer to section 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.

(2) Refer to section 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt. See section 3.8 for default listing.

(3) Refer to section 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.

(4) Refer to section 5.10.1.9 in the Model 2470 System Reference Manual for a complete discussion of the RTS DELAY prompt.

3.4 SETUP UNIT MENU

The parameters for the ISO-5167V single orifice meter application of SolarFlow Plus that can be changed in the submenus of the SETUP UNIT menu using the HHDT are tabulated as follows. The SETUP MENU has eight submenus: GENERAL, ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, AND CALC DATA. The parameters are tabulated by the HHDT prompt for the parameter, the factory-installed default, and a blank space for entering the desired value if different from the factory default.

3.4.1 GENERAL SUBMENU

The following parameters can be changed in the GENERAL submenu of the SETUP UNIT menu of the HHDT.

HHDT PROMPT	DEFAULT	DESIRED
UNIT NAME	BLANK UNIT	_____
UNIT ID	BLANK-ID	_____
CONTRCT HR	7 (0-23)	_____
LOG INTRVL	1 HOUR	_____
LOG DEFINE(1)		_____
RESET CMOD(2)	OFF	_____

NOTES:

(1) All data logs in the SolarFlow Plus memory are automatically erased and can no longer be recovered any time a change is made in the LOG DEFINE menu. Refer to section 1.9 for a description of the LOG DEFINE prompt. Refer to section 3.9 for default listing.

(2) The RESET CMOD (Reset Calculations Module) prompt selects the calculation module for an alternate SolarFlow Plus application . RESET CMOD is discussed in detail in section 5.10.2.1.6 in the Model 2470 SolarFlow Plus System Reference Manual.

3.4.2 ANALOGS SUBMENU

The ANALOGS submenu of the SETUP UNIT menu the ISO-5167V single orifice application provides for toggling between LIVE and FIXED values of the following analogs. The AUX1 key on the HHDT toggles the input between the fixed and live values. A fixed value is shown by an asterisk (*) following the analog value in the display. For additional information, refer to the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT
METR PRES	xxxxx KPa
METR TEMP	xxxxx DEG C
DIFF PRESS	xxxxx KPa
LV DENSITY	xxxxx Kg/M3
BATTERY	xxxxx VOLTS
AUX ANLG 3	xxxxx %
AUX ANLG 6	xxxxx %
LV ENERGY	xxxxx MJ/M3
FLW RT OUT	xxxxx M3/HR
VALVE POS	xxxxx %

3.4.3 SCALES SUBMENU

The high- and low-scale values for the analogs shown in the following table can be modified in the SCALES submenu of the SETUP UNIT menu. Refer to section 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

HHDT PROMPT	DEFAULT		DESIRED
M PRES/LO	0.0	KPa	_____
M PRES/HI	6900.0	KPa	_____
M TEMP/LO	-18.0	DEG C	_____
M TEMP/HI	66.0	DEG C	_____
D PRESS/LO	0.0	KPa	_____
D PRESS/HI	37.50	KPa	_____
DENSITY LO	0.0	Kg/M3	_____
DENSITY HI	100.0	Kg/M3	_____
ENERGY LO	0.0	MJ/M3	_____
ENERGY HI	100.0	MJ/M3	_____
FLW RT LOW	0	M3/HR	_____
FLW RT HI	50000.0	M3/HR	_____
VLV POS LO	0.0	%	_____
VLV POS HI	100.0	%	_____
AUX 3 LOW	0.0	%	_____
AUX 3 HI	100.0	%	_____
AUX 6 LOW	0.0	%	_____
AUX 6 HI	100.0	%	_____

3.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
OPEN 2 *	ON
CLOSE 2 *	OFF
OPEN 3 *	ON
CLOSE 3 *	OFF
OUTPUT 13	OFF
OUTPUT 14	OFF
OUTPUT 15	OFF

* Not used for this application.

3.4.5 CONFIG SUBMENU

The following default parameters can be changed in the CONFIG submenu of the SETUP UNIT menu. Refer to section 5.10.2.4 in the Model 2470 System Reference Manual for additional information about the CONFIG submenu.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
ORIF DIAM1	100.0	MM	_____
PIPE DIAM1	200.0	MM	_____
ZFLOW LIM1	0.10	KPa	_____
TAP LCTN 1	0		_____
TAP TYPE 1	0		_____
ATMS PRES	101.325	KPa	_____
PRES BASE	101.325	KPa	_____
TEMP BASE	15.0	DEG C	_____
AGA8 MTHD	0		_____
SG SELECT	1		_____
ORIF MTRL	1		_____
PIPE MTRL	0		_____
TREF ORIF	20.0	DEG C	_____
TREF PIPE	20.0	DEG C	_____
CHROM ADDR	1		_____
CHROM STRM	1		_____
VERSION	2.4		_____

3.4.6 GAS DATA

This ISO-5167V SolarFlow Plus software can accept information from the Model 2252 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 59 on the termination board. In addition, the MODBUS communication address and the chromatograph stream number desired must be programmed in by the HHDT. The Solarflow Plus will then poll the chromatograph once every four minutes automatically. Refer to section 1.5.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
SPEC GRAV	0.6000		_____
HEAT VALUE	36.251	MJ/M3	_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
VISCOSITY	0.010268	cP	_____
SPEC HEAT	1.30		_____
METHANE	95.000	MOL%	_____
ETHANE	5.000	MOL%	_____
PROPANE	0.000	MOL%	_____
H2O	0.000	MOL%	_____
H2S	0.000	MOL%	_____
HYDROGEN	0.000	MOL%	_____
CO	0.000	MOL%	_____
OXYGEN	0.000	MOL%	_____
I-BUTANE	0.000	MOL%	_____
BUTANE	0.000	MOL%	_____
I-PENTANE	0.000	MOL%	_____
PENTANE	0.000	MOL%	_____
HEXANE	0.000	MOL%	_____
HEPTANE	0.000	MOL%	_____
OCTANE	0.000	MOL%	_____
NONANE	0.000	MOL%	_____
DECANE	0.000	MOL%	_____
HELIUM	0.000	MOL%	_____
ARGON	0.000	MOL%	_____

3.4.7 CONTROL SUBMENU

The CONTROL submenu of the SETUP UNIT menu provides for entering the control values for the volume pulse outputs and valve positioning. Refer to section 1.7 for more information.

HHDT PROMPT	SAMPLE VALUES		DESIRED
VPP 1	1000	M^3	_____
PP 1	1	SEC	_____
VPP 2	1000	M^3	_____
PP 2	1	SEC	_____
VP MODE	0		_____
FLW SETPNT	0	M3/HR	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5	%	_____
PRES CHAN#	20		_____
OVRD PRESS	0	KPa	_____
DP LIMIT	0	KPa	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALVE POS	50.0	%	_____

3.4.8 CALCULATED DATA

The CALC DATA submenu of the SETUP UNIT menu allows the user to determine the calculated values for specified application inputs. The values shown here are typical values and not default values.

HHDT PROMPT	SAMPLE VALUES		DESIRED
FLOW RATE1	0	M3/HR	_____
FLOW RATE1	0.00	TON/H	_____
EV 1	1.03164		_____
CD 1	0.603166		_____
Y FCTR 1	0.999892		_____
FLW EXTN 1	0.000		_____
AGA8 MTHD	0		_____
ZS	1.038190		_____
DENSITY-B	0.8050	Kg/M3	_____
DENSITY-F1	0.750	Kg/M3	_____
B - AGA8	0.033417		_____
C - AGA8	0.002236		_____
D - AGA8	0.266296		_____
K - AGA8	0.100912		_____
MOL WT.	16.7444		_____

3.5 DISPLAY MENU

The DISPLAY Menu of the HHDT provides for viewing the various setup parameters and calculated values in a SolarFlow Plus unit at any given time. The menu is for display purposes only. No changes can be made to the values displayed using this menu. The Display menu has eight selections: ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, CALC DATA and RATE/VOLS.

3.5.1 ANALOGS

METR PRES	(KPA)
METR TEMP	(DEG C)
DIFF PRESS	(KPa)
LV DENSITY	(Kg/M3)
BATTERY	(VOLTS)
AUX ANLG 3	(%)
AUX ANLG 6	(%)
LV ENERGY	(MJ/M3)
FLW RT OUT	(M3/HR)
VALVE POS	(%)

3.5.2 SCALES

M PRES/LO	(KPA)	AUX 3 LOW	(%)
M PRES/HI	(KPa)	AUX 3 HI	(%)
M TEMP/LO	(DEG C)	AUX 6 LOW	(%)
M TEMP/HI	(DEG C)	AUX 6 HI	(%)
D PRESS/LO	(KPa)		
D PRESS/HI	(KPa)		
DENSITY LO	(Kg/M3)		
DENSITY HI	(Kg/M3)		
ENERGY LO	(MJ/M3)		
ENERGY HI	(MJ/M3)		
FLW RT LOW	(M3/HR)		
FLW RT HI	(M3/HR)		
VLV POS LO	(%)		
VLV POS HI	(%)		

3.5.3 DISCRETES

LV DENSITY
LV ENERGY
CHROM
VP 1
VP 2
INPUT 3
INPUT 4
INPUT 9
INPUT 10
INPUT 16
INPUT 17

3.5.4 CONFIG

ORIF DIAM1	(MM)
PIPE DIAM1	(MM)
ZFLOW LIM1	(KPa)
TAP LCTN 1	
TAP TYPE 1	
ATMS PRES	(KPa)
PRES BASE	(KPa)
TEMP BASE	(DEG C)
AGA8 MTHD	
SG SELECT	
ORIF MTRL	
PIPE MTRL	
TREF ORIF	(DEG C)
TREF PIPE	(DEG C)
CHROM ADDR	
CHROM STRM	
VERSION	

3.5.5 GAS DATA

SPEC GRAV	
HEAT VALUE	(MJ/M3)
CO2	(MOL%)
N2	(MOL%)
VISCOSITY	(cP)
SPEC HEAT	
METHANE	(MOL%)
ETHANE	(MOL%)
PROPANE	(MOL%)
H20	(MOL%)
H2S	(MOL%)
HYDROGEN	(MOL%)
CO	(MOL%)
OXYGEN	(MOL%)
I-BUTANE	(MOL%)
BUTANE	(MOL%)
I-PENTANE	(MOL%)
PENTANE	(MOL%)
HEXANE	(MOL%)
HEPTANE	(MOL%)
OCTANE	(MOL%)
NONANE	(MOL%)
DECANE	(MOL%)
HELIUM	(MOL%)
ARGON	(MOL%)

3.5.6 CONTROL

VPP 1	(M^3)
PP 1	(SEC)
VPP 2	(M^3)
PP 2	(SEC)
VP MODE	
FLW SETPNT	(M3/HR)
DEADBAND	(%)
SMALL STEP	(%)
LARGE STEP	(%)
FINE CNTRL	(%)
PRES CHAN#	
OVRD PRESS	(KPa)
DP LIMIT	(KPa)
PRESET POS	(%)
UPDATE TIM	(SECS)
VALVE POS	(%)

3.5.7 CALC DATA

FLOW RATE1	(M3/HR)
FLOW RATE1	(TON/H)
EV 1	
CD 1	
Y FCTR 1	
FLW EXTN 1	
AGA8 MTHD	
ZS	
DENSITY-B	(Kg/M3)
DENSITY-F1	(Kg/M3)
B - AGA8	
C - AGA8	
D - AGA8	
K - AGA8	
MOL WT.	

3.5.8 RATE/VOLS

FLOW RATE1	(M3/HR)
FLOW RATE1	(M3/DY)
TODAY VOL1	(M^3)
YSDAY VOL1	(M^3)
TOT VOL 1	(M^3)
ERATE 1	(GJ/HR)
TDY ENRGY1	(GJ)
YSY ENRGY1	(GJ)
TOT ENRGY1	(GJ)
FLOW RATE1	(TON/H)
TODAY VOL1	(TONS)
YSDAY VOL1	(TONS)
TOT VOL 1	(TONS)

3.6 CALIBRATE UNIT MENU

The CALIBRATE UNIT menu provides for calibrating the SolarFlow Plus input circuitry to match the outputs of the transmitters for analog inputs to the SolarFlow Plus unit. The CALIBRATE UNIT menu has three selections: PRESSURES, TEMP and OTHERS. Refer to section 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

3.6.1 PRESSURES

The PRESSURES selection of the CALIBRATE UNIT menu provides for calibrating the pressure inputs listed as follows:

METR PRES
DIFF PRES

3.6.2 TEMPERATURE

The TEMP selection of the CALIBRATE UNIT menu provides for calibrating the METR TEMP selection.

3.6.3 OTHERS

The analog inputs listed as follows are calibrated in the OTHERS submenu of the CALIBRATE UNIT MENU:

LV DENSITY
LV ENERGY
AUX ANLG 3
AUX ANLG 6

3.7 MONITOR MENU

The MONITOR menu provides for witness testing analog inputs to the SolarFlow Plus unit. When the MONITOR menu is entered, all analog inputs are fixed at the values being transmitted to SolarFlow Plus when MONITOR is executed. The values remain fixed until the MONITOR menu is exited. The following analog inputs listed are available in the MONITOR menu in the triple orifice application. Refer to section 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES
METR TEMP
DIFF PRESS
LV DENSITY
LV ENERGY
AUX ANLG 3
AUX ANLG 6

3.8 USER REPORT (CHANNEL 0)

Channel zero (0) is a predefined report list containing a report header and the channel data shown in the following table. The SolarFlow Plus unit displays the "USER REP" on the front panel in a scrolling format. Refer to section 3.3, "USER REP".

CHANNEL NUMBER	CHANNEL LABEL	DESCRIPTION
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in KPa
023	DIFF PRES1	Live DP, Run No.1, value in kilopascals
022	FLOW TEMP1	Live temperature in degrees Celsius (^{o}C)
025	AUX ANLG 7 (LV DENSITY)	Live value for density
134	FLOW RATE1	Flow rate for meter No.1
139	TOT VOL 1	Total volume for meter No.1
137	TODAY VOL1	Today’s volume in M3
138	YSDAY VOL1	Yesterday’s volume in M3

3.9 DATA LOG LIST CONTENTS

The following are default items included on the data log. Refer to section 3.4.1, "LOG DEFINE". The data log is set to a 1-hour log interval. The default contract hour is 7:00 AM.

CHANNEL NUMBER	CHANNEL LABEL	DECIMAL PLACES	DIGITS	LOGGING TYPE
023	DIFF PRES	2	6	AVERAGE
020	METR PRES	1	6	AVERAGE
022	FLW TEMP	1	4	AVERAGE
133	FLW TIME	1	6	SNAPSHOT & ZERO
132	FLW EXTN	3	6	AVERAGE
136	LOG VOL	0	8	SNAPSHOT & ZERO
146	LOG VOL	2	6	SNAPSHOT & ZERO

3.10 DATA LOG HEADER BLOCK CONTENTS

The data log header block includes the following items for use on data log:

M PRES/LO
M PRES/HI
M TEMP/LO
M TEMP/HI
D PRESS/LO
D PRESS/HI
ORIF DIAM1
PIPE DIAM1
ZFLOW LIM1
TAP LCTN 1
TAP TYPE 1
ATMS PRES
PRES BASE
TEMP BASE
AGA8 MTHD
SG SELECT
ORIF MTRL

(Continued on the next page)

Header Block Contents (Continued)

PIPE MTRL
TREF ORIF
TREF PIPE
SPEC GRAV
HEAT VALUE
CO2
N2
VISCOSITY
SPEC HEAT
METHANE
ETHANE
PROPANE
H2O
H2S
HYDROGEN
CO
OXYGEN
I-BUTANE
BUTANE
I-PENTANE
PENTANE
HEXANE
HEPTANE
OCTANE
NONANE
DECANE
HELIUM
ARGON

3.11 ALARM DEFINITIONS

The following is a listing of the Alarm definitions for this application. Note that the alarms will show up in the event log.

Number of Retries: 5 for alarms 1 through 9, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	C(19) < X	LOW BATTER	16.0	10.8	0.0	0
2	C(20) < X*S(20,F) or C(20) > Y*S(20,F)	METR PRES1	6900	0.0	1.01	0
3*	C(21) < X*S(21,F) or C(21) > Y*S(21,F)	AUX ANLG 3	-	0.0	1.01	0
4	C(22) < X*S(22,F) or C(22) > Y*S(22,F)	FLOW TEMP	66.0	0.0	1.01	0
5	C(23) < X*S(23,F) or C(23) > Y*S(23,F)	DIFF PRES1	37.5	0.0	1.01	0
6*	C(24) < X*S(24,F) or C(24) > Y*S(24,F)	AUX ANLG 6	-	0.0	1.01	0
7*	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	LIVE SG (LV DENSITY)	50.0	0.0	1.01	0
8*	C(26) < X*S(26,F) or C(26) > Y*S(26,F)	LV ENERGY	45.0	0.0	1.01	0
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	99999999	0
10	C(30) <> 0.0	SYS ERROR	-	0.0	0.0	0

* This alarm should be disabled.

EXAMPLE:

Alarm # 2

Y1	=	1.01
S(20,F)	=	The full-scale value for channel 20, which is the static pressure transmitter. SolarFlow Plus automatically generates this value based on the full-scale value entered while in the SETUP UNIT submenu.
F	=	6900 KPa

Therefore, the alarm setpoint for alarm #2 is 1.01(6900) = 6969 KPa.

When the ALARM menu is entered using the HHDT the user may modify the X, Y, or Z values shown in the above alarm conditions by changing the values for LOW, HIGH, and ALT. This enables the user to adjust the alarm limit(s) to match the requirements.

The value for X is represented by LOW on the HHDT ALARM SETUP menu. The value for Y is represented by HIGH on the HHDT ALARM SETUP menu. The value for Z is represented by ALT on the HHDT ALARM SETUP menu.

The ALARM menu is also used to acknowledge alarms and to activate or deactivate alarms.

To acknowledge an alarm condition displayed on the LCD of SolarFlow Plus, enter the ALARM menu of the HHDT and select the ACKNOWLEDGE sub-menu. Any existing unacknowledged alarms are displayed and the HHDT prompts: "ACKNOWLEDGE ? Y/N". Press the ENTER key to acknowledge the alarm. Once this has been done and the user has logged off SolarFlow Plus the activated alarm is displayed with the message "ACKNOWLEDGED" following the alarm condition. If the alarm condition no longer exists and has not been acknowledged it remains on the LCD until acknowledged.

To activate or deactivate alarms, enter the HHDT ALARM menu and select the SETUP sub-menu. The HHDT displays the various alarms that are available in the program. Scroll to the desired alarm and press the ENTER key at the desired alarm condition. The HHDT provides four options; STAT, LOW, HIGH, and ALT. Press ENTER at the STAT option. The HHDT shows either ON or OFF and prompts OK?. To turn off the alarm, press the NO key until OFF is displayed, then press ENTER.

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ISO - 5167V DUAL ORIFICE APPLICATION

4.0 DUAL ORIFICE APPLICATION

Section 4 covers the individual requirements for the dual orifice application (DUAL ISO-5167V) configured to calculate mass and volumetric flow rate using equations from ISO-5167:1991. The dual orifice application supports measurement on two meter tubes with a common temperature and separate meter (static) pressure. Optional capabilities such as valve positioning, chromatograph inputs, etc. are listed as part of the setup. If you do not need some of these capabilities, they may be skipped when entering the setup parameters with the Handheld Data Terminal (HHDT). Channels 1 and 2 are digital inputs which indicate whether an analog input is used for live density and energy respectively. To select fixed values, these inputs should be jumpered to ground; for live values, the inputs should be left open. Analog inputs use channels 19 through 26. Any unused analog input should be jumpered to ground.

When the SolarFlow Plus is configured for a new application, all channels are set to default values, and the Alarm definitions, Log definition, User Report list, and Analog Input channels are set to the values corresponding to the configuration chosen. The event log remains intact, but the data log is emptied.

4.1 FIELD WIRING CONNECTIONS

Before exchanging your EPROM set for working installations, make sure that all previous data is recorded as needed. Make sure that your slide switch settings are set in accordance with the information in section 1.13. No changes should be required unless the previously used application has been significantly different. Configurations for this application include the static pressure and DP transmitter(s) associated with meter 1 installed within the Model 2470 enclosure with all other transmitters installed externally, or with *all* transmitters installed externally.

The wiring configuration for the dual orifice analog inputs is shown in this section.

A field wiring diagram is provided in the Model 2470 System Reference Manual. The following information furnishes necessary details for wiring both internal and external transmitters.

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
20	INTERNAL, static pressure (factory installed)	White (Blue*) Green (Black*) Black (Red*)	23 26 25	Signal in + Analog ground 8 to 10 VDC
*	SolarFlow Plus units fitted with Statham 36PG series static pressure transmitters are wired with the blue, black, and red wires.			
		or		
20	EXTERNAL, static pressure (to be installed by user)	Blue Black Red Shield	23 26 25 24	Signal in + Analog ground 8 to 10 VDC Earth ground
21	EXTERNAL, static pressure Meter Tube No.2 (to be installed by user)	Blue Black Red Shield	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	EXTERNAL, temperature (to be installed by the user)	Blue Black Red Shield	31 34 33 32	Signal in + Analog ground 8 to 10 VDC Earth ground
23	INTERNAL, differential pressure (DP) No.1 (factory installed)	Violet Black Gray	35 38 37	Signal in + Analog ground 8 to 10 VDC
		or		
23	EXTERNAL, differential (DP) No.1 (to be installed by user)	Blue Black Red Shield	35 38 37 36	Signal in + Analog ground 8 to 10 VDC Earth ground
24	EXTERNAL, DP No.2 (to be installed by user)	Blue Black Red Shield	39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
25	EXTERNAL, LV DENSITY(1) (2) (to be installed by user)		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	EXTERNAL, LV ENERGY (to be installed by user)		47 50 49 48	Signal in + Analog ground 8 to 10 VDC Earth ground

NOTES:

(1) Since fixed values are normally desired for density and energy, digital input channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 59 and 60, 52 and 61 on the rear termination board. The fixed values for heat value and specific gravity are entered in the GAS DATA submenu of the SETUP UNIT menu by keying in the desired value. Refer to the System Wiring Diagram.

(2) Wire for connecting the external transmitter inputs is user-supplied.

(3) If only one meter run is used with this application, jumper the unused inputs to analog ground e.g., if channels 24 or 25 are not used, jumper pin No. 39 to 42 and/or pin No. 43 to 46.

4.2 STATUS SIGNAL CONNECTIONS

This application supports status inputs that are activated by a dry contact closure between the status input pin number and common.

4.2.1 INPUTS

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
1	Live or fixed density	LV DENSITY	60 59 (GND)	Open, means use live density Shorted, means calculate density
2	Live or fixed energy	LV ENERGY	61 52 (GND)	Open, means use live energy Shorted, means use fixed energy
18	Chromatograph option	CHROM	68 58 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

	CH 1	CH 2	CH 18
Live SG and HV	No jumper	No jumper	No jumper
Fixed SG and HV	Jumper/GND	Jumper/GND	No jumper
Serial Chromatograph	Jumper/GND	Jumper/GND	Jumper/GND

Note that serial chromatograph inputs require that SG and HV be jumpered to ground as if fixed.

4.2.2 OUTPUTS

NOTE: All output signals from a SolarFlow Plus unit installed in a hazardous location must be isolated by means of intrinsic safety barriers.

This application has two form-A relays (mounted on the SolarFlow Plus PC board) that provide digital outputs for corrected station volume on Channels 5 and 6. The volume per pulse and the pulse period of the relays may be changed using the HHDT. Prompts for changing the relay volume per pulse (VPP1 and VPP2) and pulse period (PP1 and PP2) are included in the discussion of the CONTROL submenu of the SETUP UNIT menu, section 4.4.7.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	15 16	Form-A relay Common
6	Volume pulse output 2	VP2	17 18	Form-A relay Common

TTL level outputs for the following channels are available at the termination board pin numbers shown in the following table.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	78 76	TTL Output Common
6	Volume pulse output 2	VP2	79 77	TTL Output Common
7	Valve control open	OPEN2	80 75	TTL Output Common
8	Valve control close	CLOSE2	81 74	TTL Output Common

4.2.3 ANALOG OUTPUT CONNECTIONS

This application provides two 1-5 VDC analog outputs.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
27	Flow rate output	FLW RT OUT	3 4	Analog Output 1 Ground
28	Valve positioning	VALVE POS	1 2	Analog Output 2 Ground

4.2.4 CHROMATOGRAPH INTER-CONNECTIONS

For more detail in wiring the Model 2252 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 systems Reference Manual.

MODEL 2252	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out Serial in Ground	102 103 106	DI in DI out DI ground

4.3 SETUP LOCATION MENU

The SolarFlow Plus operating parameters for the ISO-5167V dual orifice plate application that can be changed in the SETUP LOCATION menu are shown in the following table described by the HHDT prompt for the parameter, the factory-installed default value, and a blank space for entering the desired value if different from the factory default. Additional information on the SETUP LOCATION menu is provided in section 5.10.1 of the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT	DESIRED
LOC NAME	BLANK LOCATION	_____
LOC ID	0	_____
DATE	010180 MMDDYY	_____
WEEK DAY	1 (1-7)	_____
TIME	0000 HHMM	_____
SEC CODE(1)	120	_____
USER REP(2)	****	_____
PCOMM RATE(3)	300 BPS	_____
RTS DELAY(4)	0 1/100s	_____

NOTES:

(1) Refer to section 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.

(2) Refer to section 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt. Refer to section 4.8 in this manual for default listing.

(3) Refer to section 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.

(4) Refer to section 5.10.1.9 in the Model 2470 System Reference Manual for a complete discussion of the RTS DELAY prompt.

4.4 SETUP UNIT MENU

The parameters for the ISO-5167V dual orifice meter application of SolarFlow Plus that can be changed in the submenus of the SETUP UNIT menu using the HHDT are tabulated as follows. The SETUP MENU has eight submenus: GENERAL, ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, AND CALC DATA. The parameters are tabulated by the HHDT prompt for the parameter, the factory-installed default, and a blank space for entering the desired value if different from the factory default.

4.4.1 GENERAL SUBMENU

The following parameters can be changed in the GENERAL submenu of the SETUP UNIT menu of the HHDT.

HHDT PROMPT	DEFAULT	DESIRED
UNIT NAME	BLANK UNIT	_____
UNIT ID	BLANK-ID	_____
CONTRCT HR	7 (0-23)	_____
LOG INTRVL	1 HOUR	_____
LOG DEFINE (1)		_____
RESET CMOD(2)	OFF	_____

NOTES:

(1) All data logs in the SolarFlow Plus memory are automatically erased and can no longer be recovered any time a change is made in the LOG DEFINE menu. Refer to section 1.9 for a description of the LOG DEFINE prompt. Refer to section 4.9 for default listing.

(2) The RESET CMOD (Reset Calculations Module) prompt selects the calculation module for an alternate SolarFlow Plus application. RESET CMOD is discussed in detail in section 5.10.2.1.6 in the Model 2470 SolarFlow Plus System Reference Manual.

4.4.2 ANALOGS SUBMENU

The ANALOGS submenu of the SETUP UNIT menu of the ISO-5167V dual orifice application provides for toggling between LIVE and FIXED values of the following analogs. The AUX1 key on the HHDT toggles the input between the fixed and live values. A fixed value is shown by an asterisk (*) following the analog value in the HHDT display. For additional information, refer to the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT
METR PRES1	xxxxx KPa
METR PRES2	xxxxx KPa
METR TEMP	xxxxx DEG C
DIFF PRES1	xxxxx KPa
DIFF PRES2	xxxxx KPa
LV DENSITY	xxxxx Kg/M3
BATTERY	xxxxx VOLTS
LV ENERGY	xxxxx MJ/M3
FLW RT OUT	xxxxx M3/HR
VALVE POS	xxxxx %

4.4.3 SCALES SUBMENU

The high- and low-scale values for the analogs shown in the following table can be modified in the SCALES submenu of the SETUP UNIT menu. Refer to section 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

HHDT PROMPT	DEFAULT		DESIRED
M PRES1/LO	0.0	KPa	_____
M PRES1/HI	6900.0	KPa	_____
M PRES2/LO	0.0	KPa	_____
M PRES2/HI	6900.0	KPa	_____
M TEMP/LO	-18.0	DEG C	_____
M TEMP/HI	66.0	DEG C	_____
D PRES1/LO	0.0	KPa	_____
D PRES1/HI	37.50	KPa	_____
D PRES2/LO	0.0	KPa	_____
D PRES2/HI	37.50	KPa	_____
DENSITY LO	0.0	Kg/M3	_____
DENSITY HI	100.0	Kg/M3	_____
ENERGY LO	0.0	MJ/M3	_____
ENERGY HI	100.0	MJ/M3	_____
FLW RT LO	0	M3/HR	_____
FLW RT HI	50000.0	M3/HR	_____
VLV POS LO	0.0	%	_____
VLV POS HI	100.0	%	_____

4.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
OPEN 2	ON
CLOSE 2	OFF
OPEN 3 *	ON
CLOSE 3 *	OFF
OUTPUT 13	OFF
OUTPUT 14	OFF
OUTPUT 15	OFF

* Not used for this application.

4.4.5 CONFIG SUBMENU

The following default parameters can be changed in the CONFIG submenu of the SETUP UNIT menu. Refer to section 5.10.2.4 in the Model 2470 System Reference Manual for additional information about the CONFIG submenu.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
ORIF DIAM1	100.0	MM	_____
PIPE DIAM1	200.0	MM	_____
ZFLOW LIM1	0.10	KPa	_____
TAP LCTN 1	0		_____
TAP TYPE 1	0		_____
ORIF DIAM2	100.0	MM	_____
PIPE DIAM2	200.0	MM	_____
ZFLOW LIM2	0.10	KPa	_____
TAP LCTN 2	0		_____
TAP TYPE 2	0		_____
ATMS PRES	101.325	KPa	_____
PRES BASE	101.325	KPa	_____
TEMP BASE	15.0	DEG C	_____
AGA8 MTHD	0		_____
SG SELECT	1		_____
ORIF MTRL	1		_____
PIPE MTRL	0		_____
TREF ORIF	20.0	DEG C	_____
TREF PIPE	20.0	DEG C	_____
CHROM ADDR	1		_____
CHROM STRM	1		_____
VERSION	2.4		_____

4.4.6 GAS DATA

This ISO-5167V SolarFlow Plus software can accept information from the Model 2252 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 59 on the termination board. In addition, the MODBUS communication address and the chromatograph stream No. desired must be programmed in by the HHDT (CONFIG SUBMENU). The Solarflow Plus will then poll the chromatograph once every four minutes automatically. Refer to section 1.5.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
SPEC GRAV	0.6000		_____
HEAT VALUE	36.251	MJ/M3	_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
VISCOSITY	0.010268	cP	_____
SPEC HEAT	1.30		_____
METHANE	95.000	MOL%	_____
ETHANE	5.000	MOL%	_____
PROPANE	0.000	MOL%	_____
H2O	0.000	MOL%	_____
H2S	0.000	MOL%	_____
HYDROGEN	0.000	MOL%	_____
CO	0.000	MOL%	_____
OXYGEN	0.000	MOL%	_____
I-BUTANE	0.000	MOL%	_____
BUTANE	0.000	MOL%	_____
I-PENTANE	0.000	MOL%	_____
PENTANE	0.000	MOL%	_____
HEXANE	0.000	MOL%	_____
HEPTANE	0.000	MOL%	_____
OCTANE	0.000	MOL%	_____
NONANE	0.000	MOL%	_____
DECANE	0.000	MOL%	_____
HELIUM	0.000	MOL%	_____
ARGON	0.000	MOL%	_____

4.4.7 CONTROL SUBMENU

The CONTROL submenu of the SETUP UNIT menu provides for entering the control values primarily for the valve positioning and tube switching. Refer to sections 1.6 and 1.7 for more information.

HHDT PROMPT	DEFAULT		DESIRED
VPP 1	1000	M^3	_____
PP 1	1	SEC	_____
VPP 2	1000	M^3	_____
PP 2	1	SEC	_____
TS ENABLE	0		_____
OPEN 2 SP	25.00	KPa	_____
CLOSE 2 SP	5.00	KPa	_____
TS DELAY	30	SECS	_____
TS VLV TIM	30	SECS	_____
VP MODE	0		_____
FLW SETPNT	0	M3/HR	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5	%	_____
PRES CHAN#	20		_____
OVRD PRESS	0	KPa	_____
DP LIMIT	0	KPa	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALVE POS	50.0	%	_____

4.4.8 CALCULATED DATA

The CALC DATA submenu of the SETUP UNIT menu allows the user to determine the calculated values for specified application inputs. The values shown here are typical values and not default values.

HHDT PROMPT	SAMPLE VALUES	
AGA8 MTHD	0	
ZS	0.997811	
DENSITY-B	0.8050	Kg/M3
FLOW RATE1	0	M3/HR
FLOW RATE1	0.00	TON/H
EV 1	1.03164	
CD 1	0.603166	
Y FCTR 1	0.999892	
FLW EXTN 1	94.841	
DENSITY-F1	5.327	Kg/M3
FLOW RATE2	0	M3/HR
FLOW RATE2	0.00	TON/H
EV 2	1.0000	
CD 2	0.600000	
Y FCTR 2	1.000000	
FLW EXTN 2	0.000	
DENSITY-F2	1.000000	Kg/M3
B - AGA8	0.033417	
C - AGA8	0.002236	
D - AGA8	0.266296	
K - AGA8	0.100912	
MOL WT.	16.7444	

4.5 DISPLAY MENU

The DISPLAY Menu of the HHDT provides for viewing the various setup parameters and calculated values in a SolarFlow Plus unit at any given time. The menu is for display purposes only. No changes can be made to the values displayed using this menu. The Display menu has eight selections: ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, CALC DATA and RATE/VOLS.

4.5.1 ANALOGS

METR PRES1	(KPa)
METR PRES2	(KPa)
METR TEMP	(DEG C)
DIFF PRES1	(KPa)
DIFF PRES2	(KPa)
LV DENSITY	(Kg/M3)
BATTERY	(VOLTS)
LV ENERGY	(MJ/M3)
FLW RT OUT	(M3/HR)
VALVE POS	(%)

4.5.2 SCALES

M PRES1/LO	(KPa)	ENERGY LO	(MJ/M3)
M PRES1/HI	(KPa)	ENERGY HI	(MJ/M3)
M PRES2/LO	(KPa)	FLW RT LOW	(M3/HR)
M PRES2/HI	(KPa)	FLW RT HI	(M3/HR)
M TEMP/LO	(DEG C)	VLV POS LO	(%)
M TEMP/HI	(DEG C)	VLV POS HI	(%)
D PRES1/LO	(KPa)		
D PRES1/HI	(KPa)		
D PRES2/LO	(KPa)		
D PRES2/HI	(KPa)		
DENSITY LO	(Kg/M3)		
DENSITY HI	(Kg/M3)		

4.5.3 DISCRETES

LV DENSITY
LV ENERGY
CHROM
VP 1
VP 2
OPEN 2
CLOSE 2
INPUT 3
INPUT 4
INPUT 9
INPUT 10
INPUT 16
INPUT 17
OPEN 3
CLOSE 3
OUTPUT 13
OUTPUT 14
OUTPUT 15

4.5.4 CONFIG

ORIF DIAM1	(MM)	TREF ORIF	(DEG C)
PIPE DIAM1	(MM)	TREF PIPE	(DEG C)
ZFLOW LIM1	(KPa)	CHROM ADDR	
TAP LCTN 1		CHROM STRM	
TAP TYPE 1		VERSION	
ORIF DIAM2	(MM)		
PIPE DIAM2	(MM)		
ZFLOW LIM2	(KPa)		
TAP LCTN 2			
TAP TYPE 2			
ATMS PRES	(KPa)		
PRES BASE	(KPa)		
TEMP BASE	(DEG C)		
AGA8 MTHD			
SG SELECT			
ORIF MTRL			
PIPE MTRL			

4.5.5 GAS DATA

SPEC GRAV	
HEAT VALUE	(MJ/M3)
CO2	(MOL%)
N2	(MOL%)
VISCOSITY	(cP)
SPEC HEAT	
METHANE	(MOL%)
ETHANE	(MOL%)
PROPANE	(MOL%)
H20	(MOL%)
H2S	(MOL%)
HYDROGEN	(MOL%)
CO	(MOL%)
OXYGEN	(MOL%)
I-BUTANE	(MOL%)
BUTANE	(MOL%)
I-PENTANE	(MOL%)
PENTANE	(MOL%)
HEXANE	(MOL%)
HEPTANE	(MOL%)
OCTANE	(MOL%)
NONANE	(MOL%)
DECANE	(MOL%)
HELIUM	(MOL%)
ARGON	(MOL%)

4.5.6 CONTROL

VPP 1	(M^3)
PP 1	(SEC)
VPP 2	(M^3)
PP 2	(SEC)
TS ENABLE	
OPEN 2 SP	(KPa)
CLOSE 2 SP	(KPa)
TS DELAY	(SECS)
TS VLV TIM	(SECS)
VP MODE	
FLW SETPNT	(M3/HR)
DEADBAND	(%)
SMALL STEP	(%)
LARGE STEP	(%)
FINE CNTRL	(%)
PRES CHAN#	
OVRD PRESS	(KPa)
DP LIMIT	(KPa)
PRESET POS	(%)
UPDATE TIM	(SECS)
VALVE POS	(%)

4.5.7 CALC DATA

AGA8 MTHD	
ZS	
DENSITY-B	(Kg/M3)
FLOW RATE1	(M3/HR)
FLOW RATE1	(TON/H)
EV 1	
CD 1	
Y FCTR 1	
FLW EXTN 1	
DENSITY-F1	(Kg/M3)
FLOW RATE2	(M3/HR)
FLOW RATE2	(TON/H)
EV 2	
CD 2	
Y FCTR 2	
FLW EXTN 2	
DENSITY-F2	(Kg/M3)
B - AGA8	
C - AGA8	
D - AGA8	
K - AGA8	
MOL WT.	

4.5.8 RATE/VOLS

FLOW RATE1	(M3/HR)
FLOW RATE1	(M3/DY)
TODAY VOL1	(M^3)
YSDAY VOL1	(M^3)
TOT VOL 1	(M^3)
FLOW RATE2	(M3/HR)
FLOW RATE2	(M3/DY)
TODAY VOL2	(M^3)
YSDAY VOL2	(M^3)
TOT VOL 2	(M^3)
STN FLW RT	(M3/HR)
STN FLW RT	(M3/DY)
ST TDY VOL	(M^3)
ST YSY VOL	(M^3)
ST TOT VOL	(M^3)
ERATE 1	(GJ/HR)
TDY ENRGY1	(GJ)
YSY ENRGY1	(GJ)
TOT ENRGY1	(GJ)
ERATE 2	(GJ/HR)
TDY ENRGY2	(GJ)
YSY ENRGY2	(GJ)
TOT ENRGY2	(GJ)
STN ERATE	(GJ/HR)
TDY ENERGY	(GJ)
YSY ENERGY	(GJ)
TOT ENERGY	(GJ)
FLOW RATE1	(TON/H)
TODAY VOL1	(TONS)
YSDAY VOL1	(TONS)
TOT VOL 1	(TONS)
FLOW RATE2	(TON/H)
TODAY VOL2	(TONS)
YSDAY VOL2	(TONS)
TOT VOL 2	(TONS)
STN FLW RT	(TON/H)
ST TDY VOL	(TONS)
ST YSY VOL	(TONS)
ST TOT VOL	(TONS)

4.6 CALIBRATE UNIT MENU

The CALIBRATE UNIT menu provides for calibrating the SolarFlow Plus input circuitry to match the outputs of the transmitters for analog inputs to the SolarFlow Plus unit. The CALIBRATE UNIT menu has three selections: PRESSURES, TEMP and OTHERS. Refer to section 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

4.6.1 PRESSURES

The PRESSURES selection of the CALIBRATE UNIT menu provides for calibrating the pressure inputs listed as follows:

METR PRES1
METR PRES2
DIFF PRES1
DIFF PRES2

4.6.2 TEMPERATURE

The TEMP selection of the CALIBRATE UNIT menu provides for calibrating the METR TEMP selection.

4.6.3 OTHERS

The analog inputs listed as follows are calibrated in the OTHERS submenu of the CALIBRATE UNIT MENU:

LV DENSITY
LV ENERGY

4.7 MONITOR MENU

The MONITOR menu provides for witness testing analog inputs to the SolarFlow Plus unit. When the MONITOR menu is entered, all analog inputs are fixed at the values being transmitted to SolarFlow Plus when MONITOR is executed. The values remain fixed until the MONITOR menu is exited. The following analog inputs listed are available in the MONITOR menu in the dual orifice application. Refer to section 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES1
METR PRES2
METR TEMP
DIFF PRES1
DIFF PRES2
LV DENSITY
LV ENERGY

4.8 USER REPORT (CHANNEL 0)

Channel zero (0) is a predefined report list containing a report header and the channel data shown in the following table. The SolarFlow Plus unit displays the Users Report on the front panel in a scrolling format. Refer to section 4.3, "USER REP".

CHANNEL NUMBER	CHANNEL LABEL	DESCRIPTION
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in KPa
023	DIFF PRES1	Live DP, Run No.1, 1 value in kilopascals
021	METR PRES2	Live pressure meter No.2 in KPa
024	DIFF PRES2	Live DP, Run No.2, 1 value in kilopascals
022	FLOW TEMP1	Live temperature in degrees Celsius (°C)
025	AUX ANLG 7 (LV DENSITY)	Live value for density
134	FLOW RATE1	Flow rate for meter No.1
139	TOT VOL 1	Total volume for meter No.1
164	FLOW RATE2	Flow rate for meter No.2
169	TOT VOL 2	Total volume for meter No.2
213	ST TDY VOL	Station today's volume
214	YSDAY VOL	Station yesterday's volume

4.9 DATA LOG LIST CONTENTS

The following are default items included on the data log. Refer to section 4.4.1, "LOG DEFINE". The data log is set to a 1-hour log interval. The default contract hour is 7:00 AM.

CHANNEL NUMBER	CHANNEL LABEL	DECIMAL PLACES	DIGITS	LOGGING TYPE
023	DIFF PRES1	2	6	AVERAGE
020	METR PRES1	1	6	AVERAGE
022	FLW TEMP	1	4	AVERAGE
133	FLW TIME 1	1	6	SNAPSHOT & ZERO
132	FLW EXTN 1	3	6	AVERAGE
136	LOG VOL1	0	8	SNAPSHOT & ZERO
146	LOG VOL1	2	6	SNAPSHOT & ZERO
024	DIFF PRES2	2	6	AVERAGE
021	METR PRES2	1	6	AVERAGE
163	FLW TIME 2	1	6	SNAPSHOT & ZERO
162	FLW EXTN 2	3	6	AVERAGE
166	LOG VOL2	0	8	SNAPSHOT & ZERO
176	LOG VOL2	2	6	SNAPSHOT & ZERO

4.10 DATA LOG HEADER BLOCK CONTENTS

The data log header block includes the following items for use on data log:

M PRES1/LO
M PRES1/HI
M PRES2/LO
M PRES2/HI
M TEMP/LO
M TEMP/HI
D PRES1/LO
D PRES1/HI
D PRES2/LO
D PRES2/HI
ORIF DIAM1
PIPE DIAM1
ZFLOW LIM1
TAP LCTN 1
TAP TYPE 1
ORIF DIAM2
PIPE DIAM2
ZFLOW LIM2
TAP LCTN 2
TAP TYPE 2
ATMS PRES
PRES BASE
TEMP BASE
AGA8 MTHD
SG SELECT
ORIF MTRL
PIPE MTRL
TREF ORIF
TREF PIPE
SPEC GRAV
HEAT VALUE
CO2
N2
VISCOSITY

Data Log Header Block (Continued)

SPEC HEAT
METHANE
ETHANE
PROPANE
H2O
H2S
HYDROGEN
CO
OXYGEN
I-BUTANE
BUTANE
I-PENTANE
PENTANE
HEXANE
HEPTANE
OCTANE
NONANE
DECANE
HELIUM
ARGON

4.11 ALARM DEFINITIONS

The following is a listing of the Alarm definitions for this application. Note that the alarms will show up in the event log.
Number of Retries: 5 for alarms 1 through 9, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	C(19) < X	LOW BATTER	16.0	10.8	0.0	0
2	C(20) < X*S(20,F) or C(20) > Y*S(20,F)	METR PRES1	6900	0.0	1.01	0
3	C(21) < X*S(21,F) or C(21) > Y*S(21,F)	METR PRES2	6900	0.0	1.01	0
4	C(22) < X*S(22,F) or C(22) > Y*S(22,F)	FLOW TEMP1	66.0	0.0	1.01	0
5	C(23) < X*S(23,F) or C(23) > Y*S(23,F)	DIFF PRES1	37.5	0.0	1.01	0
6	C(24) < X*S(24,F) or C(24) > Y*S(24,F)	DIFF PRES2	37.5	0.0	1.01	0
7*	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	LIVE SG (LV DENSITY)	50.0	0.0	1.01	0
8*	C(26) < X*S(26,F) or C(26) > Y*S(26,F)	LV ENERGY	45.0	0.0	1.01	0
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	99999999	0
10	C(30) <> 0.0	SYS ERROR	-	0.0	0.0	0

* These alarms should be disabled.

EXAMPLE:

Alarm # 2

Y	=	1.01
S(20,F)	=	The full-scale value for channel 20, which is the static pressure transmitter. SolarFlow Plus automatically generates this value based on the full-scale value entered while in the SETUP UNIT submenu.
F	=	6900 KPa

Therefore, the alarm setpoint for alarm #2 is 1.01(6900) = 6969 KPa.

When the ALARM menu is entered using the HHDT the user may modify the X, Y, or Z values shown in the above alarm conditions by changing the values for LOW, HIGH, and ALT. This enables the user to adjust the alarm limit(s) to match the requirements.

The value for X is represented by LOW on the HHDT ALARM SETUP menu. The value for Y is represented by HIGH on the HHDT ALARM SETUP menu. The value for Z is represented by ALT on the HHDT ALARM SETUP menu.

The ALARM menu is also used to acknowledge alarms and to activate or deactivate alarms.

To acknowledge an alarm condition displayed on the LCD of SolarFlow Plus, enter the ALARM menu of the HHDT and select the ACKNOWLEDGE sub-menu. Any existing unacknowledged alarms are displayed and the HHDT prompts: "ACKNOWLEDGE ? Y/N". Press the ENTER key to acknowledge the alarm. Once this has been done and the user has logged off SolarFlow Plus the activated alarm is displayed with the message "ACKNOWLEDGED" following the alarm condition. If the alarm condition no longer exists and has not been acknowledged it remains on the LCD until acknowledged.

To activate or deactivate alarms, enter the HHDT ALARM menu and select the SETUP sub-menu. The HHDT displays the various alarms that are available in the program. Scroll to the desired alarm and press the ENTER key at the desired alarm condition. The HHDT provides four options; STAT, LOW, HIGH, and ALT. Press ENTER at the STAT option. The HHDT shows either ON or OFF and prompts OK?. To turn off the alarm, press the NO key until OFF is displayed, then press ENTER.

ISO - 5167V TRIPLE ORIFICE APPLICATION

5.0 TRIPLE ORIFICE APPLICATION

Section 5 covers the individual requirements for the ISO-5167V triple orifice application (TRIP ISO-5167V) configured to calculate mass and volumetric flow rate using equations from ISO-5167:1991. The triple orifice application supports measurement on three meter tubes with a common temperature and meter (static) pressure. Optional capabilities such as valve positioning, chromatograph inputs, etc. are listed as part of the setup. If you do not need some of these capabilities, they may be skipped when entering the setup parameters with the Handheld Data Terminal (HHDT). Channels 1 and 2 are digital inputs which indicate whether an analog input is used for live density and energy respectively. To select fixed values, these inputs should be jumpered to ground; for live values, the inputs should be left open. Analog inputs use channels 19 through 26. Any unused analog input should be jumpered to ground.

When the SolarFlow Plus is configured for a new application, all channels are set to default values, and the Alarm definitions, Log definition, User Report list, and Analog Input channels are set to the values corresponding to the configuration chosen. The event log remains intact, but the data log is emptied.

5.1 FIELD WIRING CONNECTIONS

Before exchanging your EPROM set for working installations, make sure that all previous data is recorded as needed. Make sure that your slide switch settings are set in accordance with the information in section 1.13. No significant changes should be required unless the previously used application has been significantly different. Configurations for this application include the static pressure and DP transmitter(s) associated with meter 1 installed within the Model 2470 enclosure with all other transmitters installed externally, or with *all* transmitters installed externally.

The wiring configuration for the triple orifice analog inputs is shown in this section.

A field wiring diagram is provided in the Model 2470 System Reference Manual. The following information furnishes necessary details for wiring both internal and external transmitters.

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
20	INTERNAL, static pressure (factory installed)	White (Blue*) Green (Black*) Black (Red*)	23 26 25	Signal in + Analog ground 8 to 10 VDC
*	SolarFlow Plus units fitted with Statham 36PG series static pressure transmitters are wired with the blue, black, and red wires.			
		or		
20	EXTERNAL, static pressure (to be installed by user)	Blue Black Red Shield	23 26 25 24	Signal in + Analog ground 8 to 10 VDC Earth ground
21	EXTERNAL, LV DENSITY (1) (2) (to be installed by user)	Blue Black Red Shield	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	EXTERNAL, temperature (to be installed by user)	Blue Black Red Shield	31 34 33 32	Signal in + Analog ground 8 to 10 VDC Earth ground
23	INTERNAL, differential pressure (DP) No. 1 (factory installed)	Violet Black Gray	35 38 37	Signal in + Analog ground 8 to 10 VDC
		or		
23	EXTERNAL, differential (DP) No. 1 (to be installed by user)	Blue Black Red Shield	35 38 37 36	Signal in + Analog ground 8 to 10 VDC Earth ground
24	EXTERNAL, DP No.2 (to be installed by user)	Blue Black Red Shield	39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
25	EXTERNAL, DP No.3 (to be installed by user)		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	EXTERNAL, LV ENERGY (to be installed by user)		47 50 49 48	Signal in + Analog ground 8 to 10 VDC Earth ground

NOTES:

(1) Since fixed values are normally desired for density and energy, digital input channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 59 and 60, 52 and 61 on the rear termination board. The fixed values for heat value and specific gravity are entered in the GAS DATA submenu of the SETUP UNIT menu by keying in the desired value. Refer to the System Wiring Diagram.

(2) Wire for connecting the external transmitter inputs is user-supplied.

(3) If only one meter run is used with this application, jumper the unused inputs to analog ground e.g., if channels 24 or 25 are not used, jumper pin No. 39 to 42 and/or pin No. 43 to 46.

5.2 STATUS SIGNAL CONNECTIONS

This application supports status inputs that are activated by a dry contact closure between the status input pin number and common.

5.2.1 INPUTS

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
1	Live or fixed density	LV DENSITY	60 59 (GND)	Open, means use live density Shorted, means calculate density
2	Live or fixed energy	LV ENERGY	61 52 (GND)	Open, means use live energy Shorted, means use fixed energy
18	Chromatograph option	CHROM	68 58 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

	CH 1	CH 2	CH 18
Live SG and HV	No jumper	No jumper	No jumper
Fixed SG and HV	Jumper/GND	Jumper/GND	No jumper
Serial Chromatograph	Jumper/GND	Jumper/GND	Jumper/GND

Note that serial chromatograph inputs require that SG and HV be jumpered to ground as if fixed.

5.2.2 OUTPUTS

NOTE: All output signals from a SolarFlow Plus unit installed in a hazardous location must be isolated by means of intrinsic safety barriers.

This application has two form-A relays (mounted on the SolarFlow Plus PC board) that provide digital outputs for corrected station volume on Channels 5 and 6. The volume per pulse and the pulse period of the relays may be changed using the HHDT. Prompts for changing the relay volume per pulse (VPP1 and VPP2) and pulse period (PP1 and PP2) are included in the discussion of the CONTROL submenu of the SETUP UNIT menu, section 5.4.7.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	15 16	Form-A relay Common
6	Volume pulse output 2	VP2	17 18	Form-A relay Common

TTL level outputs for the following channels are available at the termination board pin numbers shown in the following table.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	78 76	TTL Output Common
6	Volume pulse output 2	VP2	79 77	TTL Output Common
7	Valve control open	OPEN 2	80 75	TTL Output Common
8	Valve control close	CLOSE 2	81 74	TTL Output Common
11	Valve control open	OPEN 3	82 73	TTL Output Common
12	Valve control close	CLOSE 3	83 72	TTL Output Common

5.2.3 ANALOG OUTPUT CONNECTIONS

This application provides two 1-5 VDC analog outputs.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
27	Flow rate output	FLW RT OUT	3 4	Analog Output 1 Ground
28	Valve positioning	VALVE POS	1 2	Analog Output 2 Ground

5.2.4 CHROMATOGRAPH INTER-CONNECTIONS

For more detail in wiring the Model 2252 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 systems Reference Manual.

MODEL 2252	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out Serial in Ground	102 103 106	DI in DI out DI ground

5.3 SETUP LOCATION MENU

The SolarFlow Plus operating parameters for the ISO-5167V triple orifice meter application (TRIP ISO-5167V) that can be changed in the SETUP LOCATION menu are shown in the following table described by the HHDT prompt for the parameter, the factory-installed default value, and a blank space for entering the desired value if different from the factory default. Additional information on the SETUP LOCATION menu is provided in section 5.10.1 of the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT	DESIRED
LOC NAME	BLANK LOCATION	_____
LOC ID	0	_____
DATE	010180 MMDDYY	_____
WEEK DAY	1 (1-7)	_____
TIME	0000 HHMM	_____
SEC CODE(1)	120	_____
USER REP(2)	****	_____
PCOMM RATE(3)	300 BPS	_____
RTS DELAY(4)	0 1/100s	_____

NOTES:

(1) Refer to section 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.

(2) Refer to section 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt. Refer to section 5.8, this manual, for default listing.

(3) Refer to section 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.

(4) Refer to section 5.10.1.9 in the Model 2470 System Reference Manual for a complete discussion of the RTS DELAY prompt.

5.4 SETUP UNIT MENU

The parameters for the ISO-5167V triple orifice meter application (TRIP ISO-5167V) of SolarFlow Plus that can be changed in the submenus of the SETUP UNIT menu using the HHDT are tabulated as follows. The SETUP MENU has eight submenus: GENERAL, ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, AND CALC DATA. The parameters are tabulated by the HHDT prompt for the parameter, the factory-installed default, and a blank space for entering the desired value if different from the factory default.

5.4.1 GENERAL SUBMENU

The following parameters can be changed in the GENERAL submenu of the SETUP UNIT menu of the HHDT.

HHDT PROMPT	DEFAULT	DESIRED
UNIT NAME	BLANK UNIT	_____
UNIT ID	BLANK-ID	_____
CONTRCT HR	7 (0-23)	_____
LOG INTRVL	1 HOUR	_____
LOG DEFINE(1)		_____
RESET CMOD(2)	OFF	_____

NOTES:

(1) All data logs in the SolarFlow Plus memory are automatically erased and can no longer be recovered any time a change is made in the LOG DEFINE menu. Refer to section 1.9 for a description of the LOG DEFINE prompt. Refer to section 5.9 for default listing.

(2) The RESET CMOD (Reset Calculations Module) prompt selects the calculation module for an alternate SolarFlow Plus application. RESET CMOD is discussed in detail in section 5.10.2.1.6 in the Model 2470 SolarFlow Plus System Reference Manual.

5.4.2 ANALOGS SUBMENU

The ANALOGS submenu of the SETUP UNIT menu provides for toggling between LIVE and FIXED values of the following analogs. The AUX1 key on the HHDT toggles the input between the fixed and live values. A fixed value is shown by an asterisk (*) following the analog value in the display. for additional information, refer to the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT
METR PRES	xxxxx KPa
METR TEMP	xxxxx DEG C
DIFF PRES1	xxxxx KPa
DIFF PRES2	xxxxx KPa
DIFF PRES3	xxxxx KPa
LV DENSITY	xxxxx Kg/M3
LV ENERGY	xxxxx MJ/M3
BATTERY	xxxxx VOLTS
FLW RT OUT	xxxxx M3/HR
VALVE POS	xxxxx %

5.4.3 SCALES SUBMENU

The high- and low-scale values for the analogs shown in the following table can be modified in the SCALES submenu of the SETUP UNIT menu. Refer to section 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

HHDT PROMPT	DEFAULT		DESIRED
M PRES/LO	0.0	KPa	_____
M PRES/HI	6900.0	KPa	_____
M TEMP/LO	-18.0	DEG C	_____
M TEMP/HI	66.0	DEG C	_____
D PRES1/LO	0.0	KPa	_____
D PRES1/HI	37.50	KPa	_____
D PRES2/LO	0.0	KPa	_____
D PRES2/HI	37.50	KPa	_____
D PRES3/LO	0.0	KPa	_____
D PRES3/HI	37.50	KPa	_____
DENSITY LO*	0.0	Kg/M3	_____
DENSITY HI*	100.0	Kg/M3	_____
ENERGY LO**	0.0	MJ/M3	_____
ENERGY HI**	100.0	MJ/M3	_____
FLW RT LOW	0	M3/HR	_____
FLW RT HI	50000	M3/HR	_____
VLV POS LO	0.0	%	_____
VLV POS HI	100.0	%	_____

* Shows FIXED input; if the input is live, DENSITY/HI will read 50.00 MG/M3.

** Shows LIVE input; if the input is FIXED, ENERGY/LO will read 0.0 MJ/M3 and ENERGY/HI will read 100.0 MJ/M3.

5.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
OPEN 2	ON
CLOSE 2	OFF
OPEN 3	ON
CLOSE 3	OFF
OUTPUT 13	OFF
OUTPUT 14	OFF
OUTPUT 15	OFF

5.4.5 CONFIG SUBMENU

The following default parameters can be changed in the CONFIG submenu of the SETUP UNIT menu. Refer to section 5.10.2.4 in the Model 2470 System Reference Manual for additional information about the CONFIG submenu.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
ORIF DIAM1	100.0	MM	_____
PIPE DIAM1	200.0	MM	_____
ZFLOW LIM1	0.10	KPa	_____
TAP LCTN 1	0		_____
TAP TYPE 1	0		_____
ORIF DIAM2	100.0	MM	_____
PIPE DIAM2	200.0	MM	_____
ZFLOW LIM2	0.10	KPa	_____
TAP LCTN 2	0		_____
TAP TYPE 2	0		_____
ORIF DIAM3	100.0	MM	_____
PIPE DIAM3	200.0	MM	_____
ZFLOW LIM3	0.10	KPa	_____
TAP LCTN 3	0		_____
TAP TYPE 3	0		_____
ATMS PRES	101.325	KPa	_____
PRES BASE	101.325	KPa	_____
TEMP BASE	15.0	DEG C	_____
AGA8 MTHD	0		_____
SG SELECT	1		_____
ORIF MTRL	1		_____
PIPE MTRL	0		_____
TREF ORIF	20.0	DEG C	_____
TREF PIPE	20.0	DEG C	_____
CHROM ADDR	1		_____
CHROM STRM	1		_____
VERSION	2.4		_____

5.4.6 GAS DATA

This ISO-5167V SolarFlow Plus software can accept information from the Model 2252 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 59 on the termination board. In addition, the MODBUS communication address and the chromatograph stream No. desired must be programmed in by the HHDT (CONFIG submenu). The Solarflow Plus will then poll the chromatograph once every four minutes automatically. Refer to section 1.5.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
SPEC GRAV	0.6000		_____
HEAT VALUE	36.251	MJ/M3	_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
VISCOSITY	0.010268	cP	_____
SPEC HEAT	1.30		_____
METHANE	95.000	MOL%	_____
ETHANE	5.000	MOL%	_____
PROPANE	0.000	MOL%	_____
H2O	0.000	MOL%	_____
H2S	0.000	MOL%	_____
HYDROGEN	0.000	MOL%	_____
CO	0.000	MOL%	_____
OXYGEN	0.000	MOL%	_____
I-BUTANE	0.000	MOL%	_____
BUTANE	0.000	MOL%	_____
I-PENTANE	0.000	MOL%	_____
PENTANE	0.000	MOL%	_____
HEXANE	0.000	MOL%	_____
HEPTANE	0.000	MOL%	_____
OCTANE	0.000	MOL%	_____
NONANE	0.000	MOL%	_____
DECANE	0.000	MOL%	_____
HELIUM	0.000	MOL%	_____
ARGON	0.000	MOL%	_____

5.4.7 CONTROL SUBMENU

The CONTROL submenu of the SETUP UNIT menu provides for entering the control values primarily for the valve positioning and tube switching. Refer to sections 1.6 and 1.7 for more information.

HHDT PROMPT	DEFAULT		DESIRED
VPP 1	1000	M^3	_____
PP 1	1	SEC	_____
VPP 2	1000	M^3	_____
PP 2	1	SEC	_____
TS ENABLE	0		_____
OPEN 2 SP	25.00	KPa	_____
CLOSE 2 SP	5.00	KPa	_____
OPEN 3 SP	25.00	KPa	_____
CLOSE 3 SP	5.00	KPa	_____
TS DELAY	30	SECS	_____
TS VLV TIM	30	SECS	_____
VP MODE	0		_____
FLW SETPNT	0	M3/HR	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5	%	_____
PRES CHAN#	20		_____
OVRD PRES	0	KPa	_____
DP LIMIT	0	KPa	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALVE POS	50.0	%	_____

5.4.8 CALCULATED DATA

The CALC DATA submenu of the SETUP UNIT menu allows the user to determine the calculated values for specified application inputs. The values shown here are typical values and not default values.

HHDT PROMPT	SAMPLE VALUES	
AGA8 MTHD	0	
ZS	0.997811	
DENSITY-B	0.8050	Kg/M3
FLOW RATE1	0	M3/HR
FLOW RATE1	0.00	TON/H
EV 1	1.03164	
CD 1	0.603166	
Y FCTR 1	0.999892	
FLW EXTN 1	94.841	
DENSITY-F1	5.327	Kg/M3
FLOW RATE2	0	M3/HR
FLOW RATE2	0.00	TON/H
EV 2	1.0000	
CD 2	0.600000	
Y FCTR 2	1.000000	
FLW EXTN 2	0.000	
DENSITY-F2	5.327	Kg/M3
FLOW RATE3	0	M3/HR
FLOW RATE3	0.00	TON/H
EV 3	1.03164	
CD 3	0.604273	
Y FCTR 3	1.000000	
FLW EXTN 3	24.495	
DENSITY-F3	5.327	Kg/M3
B - AGA8	0.033417	
C - AGA8	0.002236	
D - AGA8	0.266296	
K - AGA8	0.100912	
MOL WT.	16.7444	

5.5 DISPLAY MENU

The DISPLAY Menu of the HHDT provides for viewing the various setup parameters and calculated values in a SolarFlow Plus unit at any given time. The menu is for display purposes only. No changes can be made to the values displayed using this menu. The Display menu has eight selections: ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, CALC DATA and RATE/VOLS.

5.5.1 ANALOGS

METR PRES	(KPa)
METR TEMP	(DEG C)
DIFF PRES1	(KPa)
DIFF PRES2	(KPa)
DIFF PRES3	(KPa)
LV DENSITY	(Kg/M3)
LV ENERGY	(MJ/M3)
BATTERY	(VOLTS)
FLW RT OUT	(M3/HR)
VALVE POS	(%)

5.5.2 SCALES

M PRES/LO	(KPa)	ENERGY LO	(MJ/M3)
M PRES/HI	(KPa)	ENERGY HI	(MJ/M3)
M TEMP/LO	(DEG C)	FLW RT LOW	(M3/HR)
M TEMP/HI	(DEG C)	FLW RT HI	(M3/HR)
D PRES1/LO	(KPa)	VLV POS LO	(%)
D PRES1/HI	(KPa)	VLV POS HI	(%)
D PRES2/LO	(KPa)		
D PRES2/HI	(KPa)		
D PRES3/LO	(KPa)		
D PRES3/HI	(KPa)		
DENSITY LO	(Kg/M3)		
DENSITY HI	(Kg/M3)		

5.5.3 DISCRETES

LV DENSITY
LV ENERGY
CHROM
VP 1
VP 2
OPEN 2
CLOSE 2
OPEN 3
CLOSE 3
INPUT 3
INPUT 4
INPUT 9
INPUT 10
INPUT 16
INPUT 17
OUTPUT 13
OUTPUT 14
OUTPUT 15

5.5.4 CONFIG

ORIF DIAM1	(MM)	ATMS PRES	(KPa)
PIPE DIAM1	(MM)	PRES BASE	(KPa)
ZFLOW LIM1	(KPa)	TEMP BASE	(DEG C)
TAP LCTN 1		AGA8 MTHD	
TAP TYPE 1		SG SELECT	
ORIF DIAM2	(MM)	ORIF MTRL	
PIPE DIAM2	(MM)	PIPE MTRL	
ZFLOW LIM2	(KPa)	TREF ORIF	(DEG C)
TAP LCTN 2		TREF PIPE	(DEG C)
TAP TYPE 2		CHROM ADDR	
ORIF DIAM3	(MM)	CHROM STRM	
PIPE DIAM3	(MM)	VERSION	
ZFLOW LIM3	(KPa)		
TAP LCTN 3			
TAP TYPE 3			

5.5.5 GAS DATA

SPEC GRAV	
HEAT VALUE	(MJ/M3)
CO2	(MOL%)
N2	(MOL%)
VISCOSITY	(cP)
SPEC HEAT	
METHANE	(MOL%)
ETHANE	(MOL%)
PROPANE	(MOL%)
H20	(MOL%)
H2S	(MOL%)
HYDROGEN	(MOL%)
CO	(MOL%)
OXYGEN	(MOL%)
I-BUTANE	(MOL%)
BUTANE	(MOL%)
I-PENTANE	(MOL%)
PENTANE	(MOL%)
HEXANE	(MOL%)
HEPTANE	(MOL%)
OCTANE	(MOL%)
NONANE	(MOL%)
DECANE	(MOL%)
HELIUM	(MOL%)
ARGON	(MOL%)

5.5.6 CONTROL

VPP 1	(M^3)
PP 1	(SEC)
VPP 2	(M^3)
PP 2	(SEC)
TS ENABLE	
OPEN 2 SP	(KPa)
CLOSE 2 SP	(KPa)
OPEN 3 SP	(KPa)
CLOSE 3 SP	(KPa)
TS DELAY	(SECS)
TS VLV TIM	(SECS)
VP MODE	
FLW SETPNT	(M3/HR)
DEADBAND	(%)
SMALL STEP	(%)
LARGE STEP	(%)
FINE CNTRL	(%)
PRES CHAN#	
OVRD PRESS	(KPa)
DP LIMIT	(KPa)
PRESET POS	(%)
UPDATE TIM	(SECS)
VALVE POS	(%)

5.5.7 CALC DATA

AGA8 MTHD
ZS
DENSITY-B (Kg/M3)
FLOW RATE1 (M3/HR)
FLOW RATE1 (TON/H)
EV 1
CD 1
Y FCTR 1
FLW EXTN 1
DENSITY-F1 (Kg/M3)
FLOW RATE2 (M3/HR)
FLOW RATE2 (TON/H)
EV 2
CD 2
Y FCTR 2
FLW EXTN 2
DENSITY-F2 (Kg/M3)
FLOW RATE 3 (M3/HR)
FLOW RATE 3 (TON/H)
EV 3
CD 3
Y FCTR 3
FLW EXTN 3
DENSITY-F3 (Kg/M3)
B - AGA8
C - AGA8
D - AGA8
K - AGA8
MOL WT.

5.5.8 RATE/VOLS

FLOW RATE1	(M3/HR)	FLOW RATE1	(TON/H)
FLOW RATE1	(M3/DY)	TODAY VOL1	(TONS)
TODAY VOL1	(M^3)	YSDAY VOL1	(TONS)
YSDAY VOL1	(M^3)	TOT VOL 1	(TONS)
TOT VOL 1	(M^3)	FLOW RATE2	(TON/H)
FLOW RATE2	(M3/HR)	TODAY VOL2	(TONS)
FLOW RATE2	(M3/DY)	YSDAY VOL2	(TONS)
TODAY VOL2	(M^3)	TOT VOL 2	(TONS)
YSDAY VOL2	(M^3)	FLOW RATE3	(TON/H)
TOT VOL 2	(M^3)	TODAY VOL3	(TONS)
FLOW RATE3	(M3/HR)	YSDAY VOL3	(TONS)
FLOW RATE3	(M3/DY)	TOT VOL 3	(TONS)
TODAY VOL3	(M^3)	STN FLW RT	(TON/H)
YSDAY VOL3	(M^3)	ST TDY VOL	(TONS)
TOT VOL 3	(M^3)	ST YSY VOL	(TONS)
STN FLW RT	(M3/HR)	ST TOT VOL	(TONS)
STN FLW RT	(M3/DY)		
ST TDY VOL	(M^3)		
ST YSY VOL	(M^3)		
ST TOT VOL	(M^3)		
ERATE 1	(GJ/HR)		
TDY ENRGY1	(GJ)		
YSY ENRGY1	(GJ)		
TOT ENRGY1	(GJ)		
ERATE 2	(GJ/HR)		
TDY ENRGY2	(GJ)		
YSY ENRGY2	(GJ)		
TOT ENRGY2	(GJ)		
ERATE 3	(GJ/HR)		
TDY ENRGY3	(GJ)		
YSY ENRGY3	(GJ)		
TOT ENRGY3	(GJ)		
STN ERATE	(GJ/HR)		
TDY ENERGY	(GJ)		
YSY ENERGY	(GJ)		
TOT ENERGY	(GJ)		

5.6 CALIBRATE UNIT MENU

The CALIBRATE UNIT menu provides for calibrating the SolarFlow Plus input circuitry to match the outputs of the transmitters for analog inputs to the SolarFlow Plus unit. The CALIBRATE UNIT menu has three selections: PRESSURES, TEMP and OTHERS. Refer to section 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

5.6.1 PRESSURES

The PRESSURES selection of the CALIBRATE UNIT menu provides for calibrating the pressure inputs listed as follows:

METR PRES
DIFF PRES1
DIFF PRES2
DIFF PRES3

5.6.2 TEMPERATURE

The TEMP selection of the CALIBRATE UNIT menu provides for calibrating the METR TEMP selection.

5.6.3 OTHERS

The analog inputs listed as follows are calibrated in the OTHERS submenu of the CALIBRATE UNIT MENU:

LV DENSITY
LV ENERGY

5.7 MONITOR MENU

The MONITOR menu provides for witness testing analog inputs to the SolarFlow Plus unit. When the MONITOR menu is entered, all analog inputs are fixed at the values being transmitted to SolarFlow Plus when MONITOR is executed. The values remain fixed until the MONITOR menu is exited. The following analog inputs listed are available in the MONITOR menu in the triple orifice application. Refer to section 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES	DIFF PRES3
METR TEMP	LV DENSITY
DIFF PRES1	LV ENERGY
DIFF PRES2	

5.8 USER REPORT (CHANNEL 0)

Channel zero (0) is a predefined report list containing a report header and the channel data shown in the following table. The SolarFlow Plus unit displays the Users Report on the front panel in a scrolling format. Refer to section 5.3, "USER REP".

CHANNEL NUMBER	CHANNEL LABEL	DESCRIPTION
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in KPa
022	FLOW TEMP1	Live temperature in degrees Celsius (ºC)
023	DIFF PRES1	Live DP, Run No.1, value in kilopascals
024	DIFF PRES2	Live DP, Run No.2, value in kilopascals
025	DIFF PRES3	Live DP, Run No.3, value in kilopascals
021	AUX ANLG 3 (LV DENSITY)	Live or fixed value for density
134	FLOW RATE1	Flow rate for meter No.1
139	TOT VOL 1	Total volume for meter No.1
164	FLOW RATE2	Flow rate for meter No.2
169	TOT VOL 2	Total volume for meter No.2
194	FLW RATE3	Flow rate for meter No.3
199	TOT VOL 3	Total volume for meter No.3
213	ST TDY VOL	Station today’s volume
214	YSDAY VOL	Station yesterday’s volume

5.9 DATA LOG LIST CONTENTS

The following are default items included on the data log. Refer to section 5.4.1, "LOG DEFINE". The data log is set to a 1-hour log interval. The default contract hour is 7:00 AM.

CHANNEL NUMBER	CHANNEL LABEL	DECIMAL PLACES	DIGITS	LOGGING TYPE
023	DIFF PRES1	2	6	AVERAGE
020	METR PRES	1	6	AVERAGE
022	FLW TEMP	1	4	AVERAGE
133	FLW TIME 1	1	6	SNAPSHOT & ZERO
132	FLW EXTN 1	3	6	AVERAGE
136	LOG VOL1	0	8	SNAPSHOT & ZERO
024	DIFF PRES2	2	6	AVERAGE
163	FLW TIME 2	1	6	SNAPSHOT & ZERO
162	FLW EXTN 2	3	6	AVERAGE
166	LOG VOL2	0	8	SNAPSHOT & ZERO
025	DIFF PRES3	2	6	AVERAGE
193	FLOW TIME 3	1	6	SNAPSHOT & ZERO
192	FLW EXTN 3	3	6	AVERAGE
196	LOG VOL3	0	8	SNAPSHOT & ZERO

5.10 DATA LOG HEADER BLOCK CONTENTS

The data log header block includes the following items for use on the data log:

M PRES/LO
M PRES/HI
M TEMP/LO
M TEMP/HI
D PRES1/LO
D PRES1/HI
D PRES2/LO
D PRES2/HI
D PRES3/LO
D PRES3/HI
ORIF DIAM1
PIPE DIAM1
ZFLOW LIM1
TAP LCTN 1
TAP TYPE 1
ORIF DIAM2
PIPE DIAM2
ZFLOW LIM2
TAP LCTN 2
TAP TYPE 2
ORIF DIAM3
PIPE DIAM3
ZFLOW LIM3
TAP LCTN 3
TAP TYPE 3
ATMS PRES
PRES BASE
TEMP BASE

Data Log Header Block (Continued)

AGA8 MTHD
SG SELECT
ORIF MTRL
PIPE MTRL
TREF ORIF
TREF PIPE
SPEC GRAV
HEAT VALUE
CO2
N2
VISCOSITY
SPEC HEAT
METHANE
ETHANE
PROPANE
H2O
H2S
HYDROGEN
CO
OXYGEN
I-BUTANE
BUTANE
I-PENTANE
PENTANE
HEXANE
HEPTANE
OCTANE
NONANE
DECANE
HELIUM
ARGON

5.11 ALARM DEFINITIONS

The following is a listing of the Alarm definitions for this application. Note that the alarms will show up in the event log.
Number of Retries: 5 for alarms 1 through 9, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	C(19) < X	LOW BATTER	16.0	10.8	0.0	0
2	C(20) < X*S(20,F) or C(20) > Y*S(20,F)	METR PRES1	6900	0.0	1.01	0
3*	C(21) < X*S(21,F) or C(21) > Y*S(21,F)	LIVE SG (LV DENSITY)	50.0	0.0	1.01	0
4	C(22) < X*S(22,F) or C(22) > Y*S(22,F)	FLW TEMP1	66.0	0.0	1.01	0
5	C(23) < X*S(23,F) or C(23) > Y*S(23,F)	DIFF PRES1	37.5	0.0	1.01	0
6	C(24) < X*S(24,F) or C(24) > Y*S(24,F)	DIFF PRES2	37.5	0.0	1.01	0
7	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	DIFF PRES3	37.5	0.0	1.01	0
8*	C(26) < X*S(26,F) or C(26) > Y*S(26,F)	LV ENERGY	45.0	0.0	1.01	0
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	99999999	0
10	C(30) <> 0.0	SYS ERROR	-	0.0	0.0	0

* These alarms should be disabled.

EXAMPLE:

Alarm # 2

Y	=	1.01
S(20,F)	=	The full-scale value for channel 20, which is the static pressure transmitter. SolarFlow Plus automatically generates this value based on the full-scale value entered while in the SETUP UNIT submenu.
F	=	6900 KPa

Therefore, the alarm setpoint for alarm #2 is 1.01(6900) = 6969 KPa.

When the ALARM menu is entered using the HHDT the user may modify the X, Y, or Z values shown in the above alarm conditions by changing the values for LOW, HIGH, and ALT. This enables the user to adjust the alarm limit(s) to match the requirements.

The value for X is represented by LOW on the HHDT ALARM SETUP menu. The value for Y is represented by HIGH on the HHDT ALARM SETUP menu. The value for Z is represented by ALT on the HHDT ALARM SETUP menu.

The ALARM menu is also used to acknowledge alarms and to activate or deactivate alarms.

To acknowledge an alarm condition displayed on the LCD of SolarFlow Plus, enter the ALARM menu of the HHDT and select the ACKNOWLEDGE sub-menu. Any existing unacknowledged alarms are displayed and the HHDT prompts: "ACKNOWLEDGE ? Y/N". Press the ENTER key to acknowledge the alarm. Once this has been done and the user has logged off SolarFlow Plus the activated alarm is displayed with the message "ACKNOWLEDGED" following the alarm condition. If the alarm condition no longer exists and has not been acknowledged it remains on the LCD until acknowledged.

To activate or deactivate alarms, enter the HHDT ALARM menu and select the SETUP sub-menu. The HHDT displays the various alarms that are available in the program. Scroll to the desired alarm and press the ENTER key at the desired alarm condition. The HHDT provides four options; STAT, LOW, HIGH, and ALT. Press ENTER at the STAT option. The HHDT shows either ON or OFF and prompts OK?. To turn off the alarm, press the NO key until OFF is displayed, then press ENTER.

ISO - 5167V DUAL ORIFICE COMMON APPLICATION

6.0 DUAL ORIFICE COMMON APPLICATION

Section 6 covers the individual requirements for the dual orifice common application (DUAL 5167V COM) configured to calculate mass and volumetric flow rate using equations from ISO-5167:1991. The dual orifice common application supports measurement on two meter tubes with a common temperature and meter (static) pressure. Optional capabilities such as valve positioning, chromatograph inputs, etc. are listed as part of the setup. If you do not need some of these capabilities, they may be skipped when entering the setup parameters with the Handheld Data Terminal (HHDT). Channels 1 and 2 are digital inputs which indicate whether an analog input is used for live density and energy respectively. To select fixed values, these inputs should be jumpered to ground; for live values, the inputs should be left open. Analog inputs use channels 19 through 26. Any unused analog input should be jumpered to ground.

When the SolarFlow Plus is configured for a new application, all channels are set to default values, and the Alarm definitions, Log definition, User Report list, and Analog Input channels are set to the values corresponding to the configuration chosen. The event log remains intact, but the data log is emptied.

6.1 FIELD WIRING CONNECTIONS

Before exchanging your EPROM set for working installations, make sure that all previous data is recorded as needed. Make sure that your slide switch settings are set in accordance with the information in section 1.13. No significant changes should be required unless the previously used application has been significantly different. Configurations for this application include the static pressure and DP transmitter(s) associated with meter 1 installed within the Model 2470 enclosure with all other transmitters installed externally, or with *all* transmitters installed externally.

The wiring configuration for the dual orifice common analog inputs is shown in this section.

A field wiring diagram is provided in the Model 2470 System Reference Manual. The following information furnishes necessary details for wiring both internal and external transmitters.

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
20	INTERNAL, static pressure (factory installed)	White (Blue*) Green (Black*) Black (Red*)	23 26 25	Signal in + Analog ground 8 to 10 VDC
*	SolarFlow Plus units fitted with Statham 36PG series static pressure transmitters are wired with the blue, black, and red wires.			
		or		
20	EXTERNAL, static pressure (to be installed by user)	Blue Black Red Shield	23 26 25 24	Signal in + Analog ground 8 to 10 VDC Earth ground
21	EXTERNAL, LV DENSITY(1) (2) (to be installed by user)	Blue Black Red Shield	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	EXTERNAL, temperature (to be installed by user)	Blue Black Red Shield	31 34 33 32	Signal in + Analog ground 8 to 10 VDC Earth ground
23	INTERNAL, differential pressure (DP) No.1 (factory installed)	Violet Black Gray	35 38 37	Signal in + Analog ground 8 to 10 VDC
		or		
23	EXTERNAL, differential (DP) No. 1 (to be installed by user)	Blue Black Red Shield	35 38 37 36	Signal in + Analog ground 8 to 10 VDC Earth ground
24	EXTERNAL. DP No.2 (to be installed by user)	Blue Black Red Shield	39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
25	EXTERNAL, AUX ANLG 7 (to be installed by user)		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	EXTERNAL, LV ENERGY (to be installed by user)		47 50 49 48	Signal in + Analog ground 8 to 10 VDC Earth ground

NOTES:

(1) Since fixed values are normally desired for density and energy, digital input channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 59 and 60, 52 and 61 on the rear termination board. The fixed values for heat value and specific gravity are entered in the GAS DATA submenu of the SETUP UNIT menu by keying in the desired value. Refer to the System Wiring Diagram.

(2) Wire for connecting the external transmitter inputs is user-supplied.

(3) If only one meter run is used with this application, jumper the unused inputs to analog ground e.g., if channels 24 or 25 are not used, jumper pin No. 39 to 42 and/or pin No. 43 to 46.

6.2 STATUS SIGNAL CONNECTIONS

This application supports status inputs that are activated by a dry contact closure between the status input pin number and common.

6.2.1 INPUTS

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
1	Live or fixed density	LV DENSITY	60 59 (GND)	Open, means use live density Shorted, means calculate density
2	Live or fixed energy	LV ENERGY	61 52 (GND)	Open, means use live energy Shorted, means use fixed energy
18	Chromatograph option	CHROM	68 58 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

	CH 1	CH 2	CH 18
Live SG and HV	No jumper	No jumper	No jumper
Fixed SG and HV	Jumper/GND	Jumper/GND	No jumper
Serial Chromatograph	Jumper/GND	Jumper/GND	Jumper/GND

Note that serial chromatograph inputs require that SG and HV be jumpered to ground as if fixed.

6.2.2 OUTPUTS

NOTE: All output signals from a SolarFlow Plus unit installed in a hazardous location must be isolated by means of intrinsic safety barriers.

This application has two form-A relays (mounted on the SolarFlow Plus PC board) that provide digital outputs for corrected station volume on Channels 5 and 6. The volume per pulse and the pulse period of the relays may be changed using the HHDT. Prompts for changing the relay volume per pulse (VPP1 and VPP2) and pulse period (PP1 and PP2) are included in the discussion of the CONTROL submenu of the SETUP UNIT menu, section 6.4.7.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	15 16	Form-A relay Common
6	Volume pulse output 2	VP2	17 18	Form-A relay Common

TTL level outputs for the following channels are available at the termination board pin numbers shown in the following table.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	78 76	TTL Output Common
6	Volume pulse output 2	VP2	79 77	TTL Output Common
7	Valve control open	OPEN2	80 75	TTL Output Common
8	Valve control close	CLOSE2	81 74	TTL Output Common

6.2.3 ANALOG OUTPUT CONNECTIONS

This application provides two 1-5 VDC analog outputs.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
27	Flow rate output	FLW RT OUT	3 4	Analog Output 1 Ground
28	Valve positioning	VALVE POS	1 2	Analog Output 2 Ground

6.2.4 CHROMATOGRAPH INTER-CONNECTIONS

For more detail in wiring the Model 2252 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 systems Reference Manual.

MODEL 2252	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out Serial in Ground	102 103 106	DI in DI out DI ground

6.3 SETUP LOCATION MENU

The SolarFlow Plus operating parameters for the ISO-5167V dual orifice common application that can be changed in the SETUP LOCATION menu are shown in the following table described by the HHDT prompt for the parameter, the factory-installed default value, and a blank space for entering the desired value if different from the factory default. Additional information on the SETUP LOCATION menu is provided in section 5.10.1 of the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT	DESIRED
LOC NAME	BLANK LOCATION	_____
LOC ID	0	_____
DATE	010180 MMDDYY	_____
WEEK DAY	1 (1-7)	_____
TIME	0000 HHMM	_____
SEC CODE(1)	120	_____
USER REP(2)	****	_____
PCOMM RATE(3)	300 BPS	_____
RTS DELAY(4)	0 1/100s	_____

NOTES:

(1) Refer to section 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.

(2) Refer to section 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt. Refer to section 6.8, this manual, for default listing.

(3) Refer to section 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.

(4) Refer to section 5.10.1.9 in the Model 2470 System Reference Manual for a complete discussion of the RTS DELAY prompt.

6.4 SETUP UNIT MENU

The parameters for the ISO-5167V dual orifice common application of SolarFlow Plus that can be changed in the submenus of the SETUP UNIT menu using the HHDT are tabulated as follows. The SETUP MENU has eight submenus: GENERAL, ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, AND CALC DATA. The parameters are tabulated by the HHDT prompt for the parameter, the factory-installed default, and a blank space for entering the desired value if different from the factory default.

6.4.1 GENERAL SUBMENU

The following parameters can be changed in the GENERAL submenu of the SETUP UNIT menu of the HHDT.

HHDT PROMPT	DEFAULT	DESIRED
UNIT NAME	BLANK UNIT	_____
UNIT ID	BLANK-ID	_____
CONTRCT HR	7 (0-23)	_____
LOG INTRVL	1 HOUR	_____
LOG DEFINE(1)		_____
RESET CMOD(2)	OFF	_____

NOTES:

(1) All data logs in the SolarFlow Plus memory are automatically erased and can no longer be recovered any time a change is made in the LOG DEFINE menu. Refer to section 1.9 for a description of the LOG DEFINE prompt. Refer to section 6.9 for default listing.

(2) The RESET CMOD (Reset Calculations Module) prompt selects the calculation module for an alternate SolarFlow Plus application. RESET CMOD is discussed in detail in section 5.10.2.1.6 in the Model 2470 SolarFlow Plus System Reference Manual.

6.4.2 ANALOGS SUBMENU

The ANALOGS submenu of the SETUP UNIT menu provides for toggling between LIVE and FIXED values of the following analog inputs. The AUX1 key on the HHDT toggles the input between the fixed and live values. A fixed value is shown by an asterisk (*) following the analog value in the display. For additional information, refer to the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT
METR PRES	xxxxx KPa
METR TEMP	xxxxx DEG C
DIFF PRES1	xxxxx KPa
DIFF PRES2	xxxxx KPa
AUX ANLG 7	xxxxx %
BATTERY	xxxxx VOLTS
LV DENSITY	xxxxx Kg/M3
LV ENERGY	xxxxx MJ/M3
FLW RT OUT	xxxxx M3/HR
VALVE POS	xxxxx %

6.4.3 SCALES SUBMENU

The high- and low-scale values for the analogs shown in the following table can be modified in the SCALES submenu of the SETUP UNIT menu. Refer to section 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

HHDT PROMPT	DEFAULT		DESIRED
M PRES/LO	0.0	KPa	_____
M PRES/HI	6900.0	KPa	_____
M TEMP/LO	-18.0	DEG C	_____
M TEMP/HI	66.0	DEG C	_____
D PRES1/LO	0.0	KPa	_____
D PRES1/HI	37.50	KPa	_____
D PRES2/LO	0.0	KPa	_____
D PRES2/HI	37.50	KPa	_____
AUX 7 LOW	0.0	%	_____
AUX 7 HI	100.0	%	_____
DENSITY LO	0.0	Kg/M3	_____
DENSITY HI	100.0	Kg/M3M	_____
ENERGY LO	0.0	J/M3	_____
ENERGY HI	100.0	MJ/M3	_____
FLW RT LOW	0	M3/HR	_____
FLW RT HI	50000	M3/HR	_____
VLV POS LO	0.0	%	_____
VLV POS HI	100.0	%	_____

6.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
OPEN 2	ON
CLOSE 2	OFF
OPEN 3 *	ON
CLOSE 3 *	OFF
OUTPUT 13	OFF
OUTPUT 14	OFF
OUTPUT 15	OFF

* Not used for this application.

6.4.5 CONFIG SUBMENU

The following default parameters can be changed in the CONFIG submenu of the SETUP UNIT menu. Refer to section 5.10.2.4 in the Model 2470 System Reference Manual for additional information about the CONFIG submenu.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
ORIF DIAM1	100.0	MM	_____
PIPE DIAM1	200.0	MM	_____
ZFLOW LIM1	0.10	KPa	_____
TAP LCTN 1	0		_____
TAP TYPE 1	0		_____
ORIF DIAM2	100.0	MM	_____
PIPE DIAM2	200.0	MM	_____
ZFLOW LIM2	0.10	KPa	_____
TAP LCTN 2	0		_____
TAP TYPE 2	0		_____
ATMS PRES	101.325	KPa	_____
PRES BASE	101.325	KPa	_____
TEMP BASE	15.0	DEG C	_____
AGA8 MTHD	0		_____
SG SELECT	1		_____
ORIF MTRL	1		_____
PIPE MTRL	0		_____
TREF ORIF	20.0	DEG C	_____
TREF PIPE	20.0	DEG C	_____
CHROM ADDR	1		_____
CHROM STRM	1		_____
VERSION	2.4		_____

6.4.6 GAS DATA

This ISO-5167V SolarFlow Plus software can accept information from the Model 2252 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 59 on the termination board. In addition, the MODBUS communication address and the chromatograph stream No. desired must be programmed in by the HHDT (CONFIG SUBMENU). The Solarflow Plus will then poll the chromatograph once every four minutes automatically. Refer to section 1.5.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
SPEC GRAV	0.6000		_____
HEAT VALUE	36.251	MJ/M3	_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
VISCOSITY	0.010268	cP	_____
SPEC HEAT	1.30		_____
METHANE	95.000	MOL%	_____
ETHANE	5.000	MOL%	_____
PROPANE	0.000	MOL%	_____
H2O	0.000	MOL%	_____
H2S	0.000	MOL%	_____
HYDROGEN	0.000	MOL%	_____
CO	0.000	MOL%	_____
OXYGEN	0.000	MOL%	_____
I-BUTANE	0.000	MOL%	_____
BUTANE	0.000	MOL%	_____
I-PENTANE	0.000	MOL%	_____
PENTANE	0.000	MOL%	_____
HEXANE	0.000	MOL%	_____
HEPTANE	0.000	MOL%	_____
OCTANE	0.000	MOL%	_____
NONANE	0.000	MOL%	_____
DECANE	0.000	MOL%	_____
HELIUM	0.000	MOL%	_____
ARGON	0.000	MOL%	_____

6.4.7 CONTROL SUBMENU

The CONTROL submenu of the SETUP UNIT menu provides for entering the control values primarily for the valve positioning and tube switching. Refer to sections 1.6 and 1.7 for more information.

HHDT PROMPT	DEFAULT		DESIRED
VPP 1	1000	M^3	_____
PP 1	1	SEC	_____
VPP 2	1000	M^3	_____
PP 2	1	SEC	_____
TS ENABLE	0		_____
OPEN 2 SP	25.00	KPa	_____
CLOSE 2 SP	5.00	KPa	_____
TS DELAY	30	SECS	_____
TS VLV TIM	30	SECS	_____
VP MODE	0		_____
FLW SETPNT	0	M3/HR	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5	%	_____
PRES CHAN#	20		_____
OVRD PRESS	0	KPa	_____
DP LIMIT	0	KPa	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALVE POS	50.0	%	_____

6.4.8 CALCULATED DATA

The CALC DATA submenu of the SETUP UNIT menu allows the user to determine the calculated values for specified application inputs. The values shown here are typical values and not default values.

HHDT PROMPT	SAMPLE VALUES	
AGA8 MTHD	0	
ZS	0.997811	
DENSITY-B	0.8050	Kg/M3
FLOW RATE1	0	M3/HR
FLOW RATE1	0.00	TON/H
EV 1	1.03164	
CD 1	0.603166	
Y FCTR 1	0.999892	
FLW EXTN 1	94.841	
DENSITY-F1	5.327	Kg/M3
FLOW RATE2	0	M3/HR
FLOW RATE2	0.00	TON/H
EV 2	1.0000	
CD 2	0.600000	
Y FCTR 2	1.000000	
FLW EXTN 2	0.000	
DENSITY-F2	1.000000	Kg/M3
B - AGA8	0.033417	
C - AGA8	0.002236	
D - AGA8	0.266296	
K - AGA8	0.100912	
MOL WT.	16.7444	

6.5 DISPLAY MENU

The DISPLAY Menu of the HHDT provides for viewing the various setup parameters and calculated values in a SolarFlow Plus unit at any given time. The menu is for display purposes only. No changes can be made to the values displayed using this menu. The Display menu has eight selections: ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, CALC DATA and RATE/VOLS.

6.5.1 ANALOGS

METR PRES	(KPa)
METR TEMP	(DEG C)
DIFF PRES1	(KPa)
DIFF PRES2	(KPa)
AUX ANLG 7	(%)
BATTERY	(VOLTS)
LV DENSITY	(KgM3)
LV ENERGY	(KJ/M3)
FLW RT OUT	(M3/HR)
VALVE POS	(%)

6.5.2 SCALES

M PRES/LO	(KPa)	ENERGY LO	(MJ/M3)
M PRES/HI	(KPa)	ENERGY HI	(MJ/M3)
M TEMP/LO	(DEG C)	FLW RT LOW	(M3/HR)
M TEMP/HI	(DEG C)	FLW RT HI	(M3/HR)
D PRES1/LO	(KPa)	VLV POS LO	(%)
D PRES1/HI	(KPa)	VLV POS HI	(%)
D PRES2/LO	(KPa)		
D PRES2/HI	(KPa)		
AUX 7 LOW	(%)		
AUX 7 HI	(%)		
DENSITY LO	(Kg/M3)		
DENSITY HI	(Kg/M3)		

6.5.3 DISCRETES

LV DENSITY
LV ENERGY
CHROM
VP 1
VP 2
OPEN 2
CLOSE 2
INPUT 3
INPUT 4
INPUT 9
INPUT 10
INPUT 16
INPUT 17
OPEN 3
CLOSE 3
OUTPUT 13
OUTPUT 14
OUTPUT 15

6.5.4 CONFIG

ORIF DIAM1	(MM)	SG SELECT	
PIPE DIAM1	(MM)	ORIF MTRL	
ZFLOW LIM1	(KPa)	PIPE MTRL	
TAP LCTN 1		TREF ORIF	(DEG C)
TAP TYPE 1		TREF PIPE	(DEG C)
ORIF DIAM2	(MM)	CHROM ADDR	
PIPE DIAM2	(MM)	CHROM STRM	
ZFLOW LIM2	(KPa)	VERSION	
TAP LCTN 2			
TAP TYPE 2			
ATMS PRES	(KPa)		
PRES BASE	(KPa)		
TEMP BASE	(DEG C)		
AGA8 MTHD			

6.5.5 GAS DATA

SPEC GRAV	
HEAT VALUE	(MJ/M3)
CO2	(MOL%)
N2	(MOL%)
VISCOSITY	(cP)
SPEC HEAT	
METHANE	(MOL%)
ETHANE	(MOL%)
PROPANE	(MOL%)
H20	(MOL%)
H2S	(MOL%)
HYDROGEN	(MOL%)
CO	(MOL%)
OXYGEN	(MOL%)
I-BUTANE	(MOL%)
BUTANE	(MOL%)
I-PENTANE	(MOL%)
PENTANE	(MOL%)
HEXANE	(MOL%)
HEPTANE	(MOL%)
OCTANE	(MOL%)
NONANE	(MOL%)
DECANE	(MOL%)
HELIUM	(MOL%)
ARGON	(MOL%)

6.5.6 CONTROL

VPP 1	(M^3)
PP 1	(SEC)
VPP 2	(M^3)
PP 2	(SEC)
TS ENABLE	
OPEN 2 SP	(KPa)
CLOSE 2 SP	(KPa)
TS DELAY	(SECS)
TS VLV TIM	(SECS)
VP MODE	
FLW SETPNT	(M3/HR)
DEADBAND	(%)
SMALL STEP	(%)
LARGE STEP	(%)
FINE CNTRL	(%)
PRES CHAN#	
OVRD PRESS	(KPa)
DP LIMIT	(KPa)
PRESET POS	(%)
UPDATE TIM	(SECS)
VALVE POS	(%)

6.5.7 CALC DATA

AGA8 MTHD
ZS
DENSITY-B (Kg/M3)
FLOW RATE1 (M3/HR)
FLOW RATE1 (TON/H)
EV 1
CD 1
Y FCTR 1
FLW EXTN 1
DENSITY-F1 (Kg/M3)
FLOW RATE2 (M3/HR)
FLOW RATE2 (TON/H)
EV 2
CD 2
Y FCTR 2
FLW EXTN 2
DENSITY-F2 (Kg/M3)
B - AGA8
C - AGA8
D - AGA8
K - AGA8
MOL WT.

6.5.8 RATE/VOLS

FLOW RATE1	(M3/HR)
FLOW RATE1	(M3/DY)
TODAY VOL1	(M^3)
YSDAY VOL1	(M^3)
TOT VOL 1	(M^3)
FLOW RATE2	(M3/HR)
FLOW RATE2	(M3/DY)
TODAY VOL2	(M^3)
YSDAY VOL2	(M^3)
TOT VOL 2	(M^3)
STN FLW RT	(M3/HR)
STN FLW RT	(M3/DY)
ST TDY VOL	(M^3)
ST YSY VOL	(M^3)
ST TOT VOL	(M^3)
ERATE 1	(GJ/HR)
TDY ENRGY1	(GJ)
YSY ENRGY1	(GJ)
TOT ENRGY1	(GJ)
ERATE 2	(GJ/HR)
TDY ENRGY2	(GJ)
YSY ENRGY2	(GJ)
TOT ENRGY2	(GJ)
STN ERATE	(GJ/HR)
TDY ENERGY2	(GJ)
YSY ENERGY	(GJ)
TOT ENERGY	(GJ)
FLOW RATE1	(TON/H)
TODAY VOL1	(TONS)
YSDAY VOL1	(TONS)
TOT VOL 1	(TONS)
FLOW RATE2	(TONS/H)
TODAY VOL2	(TONS)
YSDAY VOL2	(TONS)
TOT VOL 2	(TONS)
STN FLW RT	(TON/H)
ST TDY VOL	(TONS)
ST YSY VOL	(TONS)
ST TOT VOL	(TONS)

6.6 CALIBRATE UNIT MENU

The CALIBRATE UNIT menu provides for calibrating the SolarFlow Plus input circuitry to match the outputs of the transmitters for analog inputs to the SolarFlow Plus unit. The CALIBRATE UNIT menu has three selections: PRESSURES, TEMP and OTHERS. Refer to section 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

6.6.1 PRESSURES

The PRESSURES selection of the CALIBRATE UNIT menu provides for calibrating the pressure inputs listed as follows:

METR PRES
DIFF PRES1
DIFF PRES2.

6.6.2 TEMPERATURE

The TEMP selection of the CALIBRATE UNIT menu provides for calibrating the METR TEMP selection.

6.6.3 OTHERS

The analog inputs listed as follows are calibrated in the OTHERS submenu of the CALIBRATE UNIT MENU:

AUX ANLG 7
LV DENSITY
LV ENERGY.

6.7 MONITOR MENU

The MONITOR menu provides for witness testing analog inputs to the SolarFlow Plus unit. When the MONITOR menu is entered, all analog inputs are fixed at the values being transmitted to SolarFlow Plus when MONITOR is executed. The values remain fixed until the MONITOR menu is exited. The following analog inputs listed are available in the MONITOR menu in the dual orifice common application. Refer to section 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES
METR TEMP
DIFF PRES1
DIFF PRES2
AUX ANLG7
LV DENSITY
LV ENERGY

6.8 USER REPORT (CHANNEL 0)

Channel zero (0) is a predefined report list containing a report header and the channel data shown in the following table. The SolarFlow Plus unit displays the Users Report on the front panel in a scrolling format. Refer to section 6.3, "USER REP".

CHANNEL NUMBER	CHANNEL LABEL	DESCRIPTION
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in KPa
022	FLOW TEMP	Live temperature in degrees Celsius (ºC)
023	DIFF PRES1	Live DP, Run No.1, 1 value in kilopascals
024	DIFF PRES2	Live DP, Run No.2, 1 value in kilopascals
021	AUX ANLG 3 (LV DENSITY)	Live value for density
134	FLOW RATE1	Flow rate for meter No.1
139	TOT VOL 1	Total volume for meter No.1
164	FLOW RATE2	Flow rate for meter No.2
169	TOT VOL 2	Total volume for meter No.2
213	ST TDY VOL	Station today’s volume
214	YSDAY VOL	Station yesterday’s volume

6.9 DATA LOG LIST CONTENTS

The following are default items included on the data log. Refer to section 6.4.1, "LOG DEFINE". The data log is set to a 1-hour log interval. The default contract hour is 7:00 AM.

CHANNEL NUMBER	CHANNEL LABEL	DECIMAL PLACES	DIGITS	LOGGING TYPE
023	DIFF PRES1	2	6	AVERAGE
020	METR PRES	1	6	AVERAGE
022	FLW TEMP	1	4	AVERAGE
133	FLW TIME 1	1	6	SNAPSHOT & ZERO
132	FLW EXTN 1	3	6	AVERAGE
136	LOG VOL1	0	8	SNAPSHOT & ZERO
146	LOG VOL1	2	6	SNAPSHOT & ZERO
024	DIFF PRES2	2	6	AVERAGE
163	FLW TIME 2	1	6	SNAPSHOT & ZERO
162	FLW EXTN 2	3	6	AVERAGE
166	LOG VOL2	0	8	SNAPSHOT & ZERO
176	LOG VOL2	2	6	SNAPSHOT & ZERO

6.10 DATA LOG HEADER BLOCK CONTENTS

The data log header block includes the following items for use on data log:

M PRES1/LO
M PRES1/HI
M TEMP/LO
M TEMP/HI
D PRES1/LO
D PRES1/HI
D PRES2/LO
D PRES2/HI
ORIF DIAM1
PIPE DIAM1
ZFLOW LIM1
TAP LCTN 1
TAP TYPE 1
ORIF DIAM2
PIPE DIAM2
ZFLOW LIM2
TAP LCTN 2
TAP TYPE 2
ATMS PRES
PRES BASE
TEMP BASE
AGA8 MTHD
SG SELECT
ORIF MTRL
PIPE MTRL
TREF ORIF
TREF PIPE
SPEC GRAV
HEAT VALUE
CO2
N2
VISCOSITY

(Continued on the next page)

SPEC HEAT
METHANE
ETHANE
PROPANE
H2O
H2S
HYDROGEN
CO
OXYGEN
I-BUTANE
BUTANE
I-PENTANE
PENTANE
HEXANE
HEPTANE
OCTANE
NONANE
DECANE
HELIUM
ARGON

6.11 ALARM DEFINITIONS

The following is a listing of the Alarm definitions for this application. Note that the alarms will show up in the event log.
Number of Retries: 5 for alarms 1 through 9, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	C(19) < X	LOW BATTER	16.0	10.8	0.0	0
2	C(20) < X*S(20,F) or C(20) > Y*S(20,F)	METR PRES1	6900	0.0	1.01	0
3*	C(21) < X*S(21,F) or C(21) > Y*S(21,F)	LIVE SG (LV DENSITY)	50.0	0.0	1.01	0
4	C(22) < X*S(22,F) or C(22) > Y*S(22,F)	FLOW TEMP1	66.0	0.0	1.01	0
5	C(23) < X*S(23,F) or C(23) > Y*S(23,F)	DIFF PRES1	37.5.	0.0	1.01	0
6	C(24) < X*S(24,F) or C(24) > Y*S(24,F)	DIFF PRES2	37.50	0.0	1.01	0
7*	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	AUX ANLG 7	-	0.0	1.01	0
8*	C(26) < X*S(26,F) or C(26) > Y*S(26,F)	LV ENERGY	45.0	0.0	1.01	0
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	99999999	0
10	C(30) <> 0.0	SYS ERROR	-	0.0	0.0	0

* These alarms should be disabled.

EXAMPLE:

Alarm # 2

Y	=	1.01
S(20,F)	=	The full-scale value for channel 20, which is the static pressure transmitter. SolarFlow Plus automatically generates this value based on the full-scale value entered while in the SETUP UNIT submenu.
F	=	6900 KPa

Therefore, the alarm setpoint for alarm #2 is 1.01(6900) = 6969 KPa.

When the ALARM menu is entered using the HHDT the user may modify the X, Y, or Z values shown in the above alarm conditions by changing the values for LOW, HIGH, and ALT. This enables the user to adjust the alarm limit(s) to match the requirements.

The value for X is represented by LOW on the HHDT ALARM SETUP menu. The value for Y is represented by HIGH on the HHDT ALARM SETUP menu. The value for Z is represented by ALT on the HHDT ALARM SETUP menu.

The ALARM menu is also used to acknowledge alarms and to activate or deactivate alarms.

To acknowledge an alarm condition displayed on the LCD of SolarFlow Plus, enter the ALARM menu of the HHDT and select the ACKNOWLEDGE sub-menu. Any existing unacknowledged alarms are displayed and the HHDT prompts: "ACKNOWLEDGE ? Y/N". Press the ENTER key to acknowledge the alarm. Once this has been done and the user has logged off SolarFlow Plus the activated alarm is displayed with the message "ACKNOWLEDGED" following the alarm condition. If the alarm condition no longer exists and has not been acknowledged it remains on the LCD until acknowledged.

To activate or deactivate alarms, enter the HHDT ALARM menu and select the SETUP sub-menu. The HHDT displays the various alarms that are available in the program. Scroll to the desired alarm and press the ENTER key at the desired alarm condition. The HHDT provides four options; STAT, LOW, HIGH, and ALT. Press ENTER at the STAT option. The HHDT shows either ON or OFF and prompts OK?. To turn off the alarm, press the NO key until OFF is displayed, then press ENTER.

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ISO - 5167V STACKED SINGLE ORIFICE APPLICATION

7.0 STACKED SINGLE ORIFICE APPLICATION

Section 7 covers the individual requirements for the ISO-5167V stacked single orifice application (SSNGL ISO-5167V) configured to calculate mass and volumetric flow rate using equations from ISO-5167:1991. The stacked single orifice application supports measurement on one meter tube with stacked differential pressure transmitters. Optional capabilities such as valve positioning, chromatograph inputs, etc. are listed as part of the setup. If you do not need some of these capabilities, they may be skipped when entering the setup parameters with the Handheld Data Terminal (HHDT). Channels 1 and 2 are digital inputs which indicate whether an analog input is used for live density and energy respectively. To select fixed values, these inputs should be jumpered to ground; for live values, the inputs should be left open. Analog inputs use Channels 19 through 26. Any unused analog input should be jumpered to ground.

When the SolarFlow Plus is configured for a new application, all channels are set to default values, and the Alarm definitions, Log definition, User Report list, and Analog Input channels are set to the values corresponding to the configuration chosen. The event log remains intact, but the data log is emptied.

7.1 FIELD WIRING CONNECTIONS

Before exchanging your EPROM set for working installations, make sure that all previous data is recorded as needed. Make sure that your slide switch settings are set in accordance with the information in section 1.13. No changes should be required unless the previously used application has been significantly different. Configurations for this application include the static pressure and DP transmitter(s) associated with meter 1 installed within the Model 2470 enclosure with all other transmitters installed externally, or with *all* transmitters installed externally.

The wiring configuration for the stacked single orifice analog inputs is shown in this section.

A field wiring diagram is provided in the Model 2470 System Reference Manual. The following information furnishes necessary details for wiring both internal and external transmitters.

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
20	INTERNAL, static pressure (factory installed)	White (Blue*) Green (Black*) Black (Red*)	23 26 25	Signal in + Analog ground 8 to 10 VDC
*	SolarFlow Plus units fitted with Statham 36PG series static pressure transmitters are wired with the blue, black, and red wires.			
		or		
20	EXTERNAL, static pressure (to be installed by user)	Blue Black Red Shield	23 26 25 24	Signal in + Analog ground 8 to 10 VDC Earth ground
21	EXTERNAL, AUX ANLG3 (to be installed by user)	Blue Black Red Shield	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	EXTERNAL, temperature (to be installed by user)	Blue Black Red Shield	31 34 33 32	Signal in + Analog ground 8 to 10 VDC Earth ground
23	INTERNAL, differential pressure (low) No.1 (factory installed)	Violet Black Gray	35 38 37	Signal in + Analog ground 8 to 10 VDC
		or		
23	EXTERNAL, differential pressure low (DP) No. 1 (to be installed by user)	Blue Black Red Shield	35 38 37 36	Signal in + Analog ground 8 to 10 VDC Earth ground

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
24	EXTERNAL, DP high No.1 (to be installed by user)	Blue Black Red Shield	39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground
25	EXTERNAL, LV DENSITY (1) (2) (to be installed by user)		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	EXTERNAL, LV ENERGY (to be installed by user)		47 50 49 48	Signal in + Analog ground 8 to 10 VDC Earth ground

NOTES:

(1) Since fixed values are normally desired for density and energy, digital input Channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 59 and 60, 52 and 61 on the rear termination board. The fixed values for heat value and specific gravity are entered in the GAS DATA submenu of the SETUP UNIT menu by keying in the desired value. Refer to the System Wiring Diagram.

(2) Wire for connecting the external transmitter inputs is user-supplied.

(3) Jumper any unused analog input to analog ground.

7.2 STATUS SIGNAL CONNECTIONS

This application supports status inputs that are activated by a dry contact closure between the status input pin number and common.

7.2.1 INPUTS

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
1	Live or fixed density	LV DENSITY	60 59 (GND)	Open, means use live density Shorted, means calculate density
2	Live or fixed energy	LV ENERGY	61 52 (GND)	Open, means use live energy Shorted, means use fixed energy
18	Chromatograph option	CHROM	68 58 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

	CH 1	CH 2	CH 18
Live SG and HV	No jumper	No jumper	No jumper
Fixed SG and HV	Jumper/GND	Jumper/GND	No jumper
Serial Chromatograph	Jumper/GND	Jumper/GND	Jumper/GND

Note that serial chromatograph inputs require that SG and HV be jumpered to ground as if fixed.

7.2.2 OUTPUTS

NOTE: All output signals from a SolarFlow Plus unit installed in a hazardous location must be isolated by means of intrinsic safety barriers.

This application has two form-A relays (mounted on the SolarFlow Plus PC board) that provide digital outputs for corrected station volume on Channels 5 and 6. The volume per pulse and the pulse period of the relays may be changed using the HHDT. Prompts for changing the relay volume per pulse (VPP1 and VPP2) and pulse period (PP1 and PP2) are included in the discussion of the CONTROL submenu of the SETUP UNIT menu, section 7.4.7.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	15 16	Form-A relay Common
6	Volume pulse output 2	VP2	17 18	Form-A relay Common

TTL level outputs for the following channels are available at the termination board pin numbers shown in the following table.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	78 76	TTL Output Common
6	Volume pulse output 2	VP2	79 77	TTL Output Common

7.2.3 ANALOG OUTPUT CONNECTIONS

This application provides one 1-5 VDC analog output.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
27	Flow rate output	FLW RT OUT	3 4	Analog output 1 Ground
28	Valve positioning	VALVE POS	1 2	Analog output 2 Ground

7.2.4 CHROMATOGRAPH INTER-CONNECTIONS

For more detail in wiring the Model 2252 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 systems Reference Manual.

MODEL 2252	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out Serial in Ground	102 103 106	DI in DI out DI ground

7.3 SETUP LOCATION MENU

The SolarFlow Plus operating parameters for the ISO-5167V stacked single orifice application that can be changed in the SETUP LOCATION menu are shown in the following table described by the HHDT prompt for the parameter, the factory-installed default value, and a blank space for entering the desired value if different from the factory default. Additional information on the SETUP LOCATION menu is provided in section 5.10.1 of the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT	DESIRED
LOC NAME	BLANK LOCATION	_____
LOC ID	0	_____
DATE	010180 MMDDYY	_____
WEEK DAY	1 (1-7)	_____
TIME	0000 HHMM	_____
SEC CODE(1)	120	_____
USER REP(2)	****	_____
PCOMM RATE(3)	300 BPS	_____
RTS DELAY(4)	0 1/100s	_____

NOTES:

(1) Refer to section 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.

(2) Refer to section 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt. Refer to section 7.8, this manual, for default listing.

(3) Refer to section 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.

(4) Refer to section 5.10.1.9 in the Model 2470 System Reference Manual for a complete discussion of the RTS DELAY prompt.

7.4 SETUP UNIT MENU

The parameters for the ISO-5167V stacked single orifice application of SolarFlow Plus that can be changed in the submenus of the SETUP UNIT menu using the HHDT are tabulated as follows. The SETUP MENU has eight submenus: GENERAL, ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, AND CALC DATA. The parameters are tabulated by the HHDT prompt for the parameter, the factory-installed default, and a blank space for entering the desired value if different from the factory default.

7.4.1 GENERAL SUBMENU

The following parameters can be changed in the GENERAL submenu of the SETUP UNIT menu of the HHDT.

HHDT PROMPT	DEFAULT	DESIRED
UNIT NAME	BLANK UNIT	_____
UNIT ID	BLANK-ID	_____
CONTRCT HR	7 (0-23)	_____
LOG INTRVL	1 HOUR	_____
LOG DEFINE(1)		_____
RESET CMOD(2)	OFF	_____

NOTES:

(1) All data logs in the SolarFlow Plus memory are automatically erased and can no longer be recovered any time a change is made in the LOG DEFINE menu. Refer to section 1.9 for a description of the LOG DEFINE prompt. Refer to section 7.9 for default listing.

(2) The RESET CMOD (Reset Calculations Module) prompt selects the calculation module for an alternate SolarFlow Plus application. RESET CMOD is discussed in detail in section 5.10.2.1.6 in the Model 2470 SolarFlow Plus System Reference Manual.

7.4.2 ANALOGS SUBMENU

The ANALOGS submenu of the SETUP UNIT menu of the ISO-5167V stacked single orifice application provides for toggling between LIVE and FIXED values of the following analog inputs. The AUX1 key on the HHDT toggles the input between the fixed and live values. A fixed value is shown by an asterisk (*) following the analog value in the HHDT display. For additional information, refer to the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT
METR PRES	xxxxx KPa
METR TEMP	xxxxx DEG C
DIFF PRESL	xxxxx KPa
DIFF PRESH	xxxxx KPa
SPEC HEAT	xxxxx
LV DENSITY	xxxxx Kg/M3
BATTERY	xxxxx VOLTS
AUX ANLG3	xxxxx %
LV ENERGY	xxxxx MJ/M3
FLW RT OUT	xxxxx M3/HR
VALVE POS	xxxxx %

7.4.3 SCALES SUBMENU

The high- and low-scale setpoints for the analog inputs shown in the following table can be modified in the SCALES submenu of the SETUP UNIT menu. Refer to section 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

HHDT PROMPT	DEFAULT		DESIRED
M PRES/LO	0.0	KPa	_____
M PRES/HI	6900.0	KPa	_____
M TEMP/LO	-18.0	DEG C	_____
M TEMP/HI	66.0	DEG C	_____
D PRESL/LO	0.0	KPa	_____
D PRESL/HI	7.50	KPa	_____
D PRESH/LO	0.0	KPa	_____
D PRESH/HI	37.50	KPa	_____
DENSITY LO	0.0	Kg/M3	_____
DENSITY HI	100.0	Kg/M3	_____
ENERGY LO	0.0	MJ/M3	_____
ENERGY HI	100.0	MJ/M3	_____
FLW RT LOW	0	M3/HR	_____
FLW RT HI	50000	M3/HR	_____
VLV POS LO	0.0	%	_____
VLV POS HI	100.0	%	_____
AUX 3 LOW	0.0	%	_____
AUX 3 HI	100.0	%	_____

7.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
OPEN 2 *	ON
CLOSE 2 *	OFF
OPEN 3 *	ON
CLOSE 3 *	OFF
OUTPUT 13	OFF
OUTPUT 14	OFF
OUTPUT 15	OFF

* Not used for this application.

7.4.5 CONFIG SUBMENU

The following default parameters can be changed in the CONFIG submenu of the SETUP UNIT menu. Refer to section 5.10.2.4 in the Model 2470 System Reference Manual for additional information about the CONFIG submenu.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
ORIF DIAM1	100.0	MM	_____
PIPE DIAM1	200.0	MM	_____
ZFLOW LIM1	0.10	KPa	_____
TAP LCTN 1	0		_____
TAP TYPE 1	0		_____
ATMS PRES	101.325	KPa	_____
PRES BASE	101.325	KPa	_____
TEMP BASE	15.0	DEG C	_____
AGA8 MTHD	0		_____
SG SELECT	1		_____
ORIF MTRL	1		_____
PIPE MTRL	0		_____
TREF ORIF	20.0	DEG C	_____
TREF PIPE	20.0	DEG C	_____
CHROM ADDR	1		_____
CHROM STRM	1		_____
VERSION	2.4		_____

7.4.6 GAS DATA

This ISO-5167V SolarFlow Plus software can accept information from the Model 2252 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 59 on the termination board. In addition, the MODBUS communication address and the chromatograph stream No. desired must be programmed in by the HHDT (CONFIG SUBMENU). The Solarflow Plus will then poll the chromatograph once every four minutes automatically. Refer to section 1.5.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
SPEC GRAV	0.6000		_____
HEAT VALUE	36.251	MJ/M3	_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
VISCOSITY	0.010268	cP	_____
SPEC HEAT	1.30		_____
METHANE	95.000	MOL%	_____
ETHANE	5.000	MOL%	_____
PROPANE	0.000	MOL%	_____
H2O	0.000	MOL%	_____
H2S	0.000	MOL%	_____
HYDROGEN	0.000	MOL%	_____
CO	0.000	MOL%	_____
OXYGEN	0.000	MOL%	_____
I-BUTANE	0.000	MOL%	_____
BUTANE	0.000	MOL%	_____
I-PENTANE	0.000	MOL%	_____
PENTANE	0.000	MOL%	_____
HEXANE	0.000	MOL%	_____
HEPTANE	0.000	MOL%	_____
OCTANE	0.000	MOL%	_____
NONANE	0.000	MOL%	_____
DECANE	0.000	MOL%	_____
HELIUM	0.000	MOL%	_____
ARGON	0.000	MOL%	_____

7.4.7 CONTROL SUBMENU

The CONTROL submenu of the SETUP UNIT menu provides for entering the control values primarily for the valve positioning and tube switching. Refer to sections 1.6 and 1.7 for more information.

HHDT PROMPT	DEFAULT		DESIRED
VPP 1	1000	M^3	_____
PP 1	1	SEC	_____
VPP 2	1000	M^3	_____
PP 2	1	SEC	_____
VP MODE	0		_____
FLW SETPNT	0	M3/HR	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5	%	_____
PRES CHAN#	20		_____
OVRD PRESS	0	KPa	_____
DP LIMIT	0	KPa	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALVE POS	50.0	%	_____

7.4.8 CALCULATED DATA

The CALC DATA submenu of the SETUP UNIT menu allows the user to determine the calculated values for specified application inputs. The values shown here are typical values and not default values.

HHDT PROMPT	SAMPLE VALUES	
FLOW RATE1	0	M3/HR
FLOW RATE1	0.00	TON/H
EV 1	1.03164	
CD 1	0.603166	
Y FCTR 1	0.999892	
FLW EXTN 1	0.000	
AGA8 MTHD	0	
ZS	0.997811	
DENSITY-B	0.750	Kg/M3
DENSITY-F1	5.3277	Kg/M3
B - AGA8	0.033417	
C - AGA8	0.002236	
D - AGA8	0.266296	
K - AGA8	0.100912	
MOL WT.	16.7444	

7.5 DISPLAY MENU

DISPLAY Menu of the HHDT provides for viewing the various setup parameters and calculated values in a SolarFlow Plus unit at any given time. The menu is for display purposes only. No changes can be made to the values displayed using this menu. The Display menu has eight selections: ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, CALC DATA and RATE/VOLS.

7.5.1 ANALOGS

METR PRES	(KPa)
METR TEMP	(DEG C)
DIFF PRESL	(KPa)
DIFF PRESH	(KPa)
SPEC HEAT	
LV DENSITY	(Kg/M3)
BATTERY	(VOLTS)
AUX ANLG 3	(%)
LV ENERGY	(MJ/M3)
FLW RT OUT	(M3/HR)
VALVE POS	(%)

7.5.2 SCALES

M PRES/LO	(KPa)	ENERGY LO	(MJ/M3)
M PRES/HI	(KPa)	ENERGY HI	(MJ/M3)
M TEMP/LO	(DEG C)	FLW RT LOW	(M3/HR)
M TEMP/HI	(DEG C)	FLW RT HI	(M3/HR)
D PRESL/LO	(KPa)	VLV POS LO	(%)
D PRESL/HI	(KPa)	VLV POS HI	(%)
D PRESH/LO	(KPa)	AUX 3 LOW	(%)
D PRESH/HI	(KPa)	AUX 3 HI	(%)
DENSITY LO	(Kg/M3)		
DENSITY HI	(Kg/M3)		

7.5.3 DISCRETES

LV DENSITY
LV ENERGY
CHROM
VP 1
VP 2
INPUT 3
INPUT 4
INPUT 9
INPUT 10
INPUT 16
INPUT 17

7.5.4 CONFIG

ORIF DIAM1	(MM)
PIPE DIAM1	(MM)
ZFLOW LIM1	(KPa)
TAP LCTN 1	
TAP TYPE 1	
ATMS PRES	(KPa)
PRES BASE	(KPa)
TEMP BASE	(DEG C)
AGA8 MTHD	
SG SELECT	
ORIF MTRL	
PIPE MTRL	
TREF ORIF	(DEG C)
TREF PIPE	(DEG C)
CHROM ADDR	
CHROM STRM	
VERSION	

7.5.5 GAS DATA

SPEC GRAV	
HEAT VALUE	(MJ/M3)
CO2	(MOL%)
N2	(MOL%)
VISCOSITY	(cP)
SPEC HEAT	
METHANE	(MOL%)
ETHANE	(MOL%)
PROPANE	(MOL%)
H20	(MOL%)
H2S	(MOL%)
HYDROGEN	(MOL%)
CO	(MOL%)
OXYGEN	(MOL%)
I-BUTANE	(MOL%)
BUTANE	(MOL%)
I-PENTANE	(MOL%)
PENTANE	(MOL%)
HEXANE	(MOL%)
HEPTANE	(MOL%)
OCTANE	(MOL%)
NONANE	(MOL%)
DECANE	(MOL%)
HELIUM	(MOL%)
ARGON	(MOL%)

7.5.6 CONTROL

VPP 1	(M^3)
PP 1	(SEC)
VPP 2	(M^3)
PP 2	(SEC)
VP MODE	
FLW SETPNT	(M3/HR)
DEADBAND	(%)
SMALL STEP	(%)
LARGE STEP	(%)
FINE CNTRL	(%)
PRES CHAN#	
OVRD PRESS	(KPa)
DP LIMIT	(KPa)
PRESET POS	(%)
UPDATE TIM	(SECS)
VALVE POS	(%)

7.5.7 CALC DATA

FLOW RATE1	(M3/HR)
FLOW RATE1	(TON/HR)
EV 1	
CD 1	
Y FCTR 1	
FLW EXTN 1	
AGA8 MTHD	
ZS	
DENSITY-B	(Kg/M3)
DENSITY-F1	(Kg/M3)
B - AGA8	
C - AGA8	
D - AGA8	
K - AGA8	
MOL WT.	

7.5.8 RATE/VOLS

FLOW RATE1	(M3/HR)
FLOW RATE1	(M3/DY)
TODAY VOL1	(M^3)
YSDAY VOL1	(M^3)
TOT VOL 1	(M^3)
ERATE 1	(GJ/HR)
TDY ENRGY1	(GJ)
YSY ENRGY1	(GJ)
TOT ENRGY1	(GJ)
FLOW RATE1	(TON/H)
TODAY VOL1	(TONS)
YSDAY VOL1	(TONS)
TOT VOL 1	(TONS)

7.6 CALIBRATE UNIT MENU

The CALIBRATE UNIT menu provides for calibrating the SolarFlow Plus input circuitry to match the outputs of the transmitters for analog inputs to the SolarFlow Plus unit. The CALIBRATE UNIT menu has three selections: PRESSURES, TEMP and OTHERS. Refer to section 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

7.6.1 PRESSURES

The PRESSURES selection of the CALIBRATE UNIT menu provides for calibrating the pressure inputs listed as follows:

METR PRES
DIFF PRESL
DIFF PRESH

7.6.2 TEMPERATURE

The TEMP selection of the CALIBRATE UNIT menu provides for calibrating the METR TEMP selection.

7.6.3 OTHERS

The analog inputs listed as follows are calibrated in the OTHERS submenu of the CALIBRATE UNIT MENU:

LV DENSITY
LV ENERGY
AUX ANLG 3

7.7 MONITOR MENU

The MONITOR menu provides for witness testing analog inputs to the SolarFlow Plus unit. When the MONITOR menu is entered, all analog inputs are fixed at the values being transmitted to SolarFlow Plus when MONITOR is executed. The values remain fixed until the MONITOR menu is exited. The following analog inputs listed are available in the MONITOR menu in the stacked single orifice application. Refer to section 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES
METR TEMP
DIFF PRESL
DIFF PRESH
LV DENSITY
LV ENERGY
AUX ANLG 3

7.8 USER REPORT (CHANNEL 0)

Channel zero (0) is a predefined report list containing a report header and the channel data shown in the following table. The SolarFlow Plus unit displays the Users Report on the front panel in a scrolling format. Refer to section 7.3, "USER REP".

CHANNEL NUMBER	CHANNEL LABEL	DESCRIPTION
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in KPa
032	COMP DPRES	Composite DP, Run No.1, value in kilopascals
022	FLOW TEMP1	Live temperature in degrees Celsius (^{o}C)
025	AUX ANLG 7 (LV DENSITY)	Live value for density
134	FLOW RATE1	Flow rate for meter No.1
139	TOT VOL 1	Total volume for meter No.1
137	TODAY VOL1	Today’s volume in M3
138	YSDAY VOL1	Yesterday’s volume in M3

7.9 DATA LOG LIST CONTENTS

The following are default items included on the data log. Refer to section 7.4.1, "LOG DEFINE". The data log is set to a 1-hour log interval. The default contract hour is 7:00 AM.

CHANNEL NUMBER	CHANNEL LABEL	DECIMAL PLACES	DIGITS	LOGGING TYPE
032	COMP DPRES	2	6	AVERAGE
020	METR PRES	1	6	AVERAGE
022	FLW TEMP	1	4	AVERAGE
133	FLW TIME	1	6	SNAPSHOT & ZERO
132	FLW EXTN	3	6	AVERAGE
136	LOG VOL	0	8	SNAPSHOT & ZERO
146	LOG VOL	2	6	SNAPSHOT & ZERO

7.10 DATA LOG HEADER BLOCK CONTENTS

The data log header block includes the following items for use on data log:

M PRES/LO
M PRES/HI
M TEMP/LO
M TEMP/HI
D PRESL/LO
D PRESL/HI
D PRESH/LO
D PRESH/HI
ORIF DIAM1
PIPE DIAM1
ZFLOW LIM1
TAP LCTN 1
TAP TYPE 1
ATMS PRES
PRES BASE
TEMP BASE

(Continued on the next page)

Data Log Header Block (Continued)

AGA8 MTHD
SG SELECT
ORIF MTRL
PIPE MTRL
TREF ORIF
TREF PIPE
SPEC GRAV
HEAT VALUE
CO2
N2
VISCOSITY
SPEC HEAT
METHANE
ETHANE
PROPANE
H2O
H2S
HYDROGEN
CO
OXYGEN
I-BUTANE
BUTANE
I-PENTANE
PENTANE
HEXANE
HEPTANE
OCTANE
NONANE
DECANE
HELIUM
ARGON

7.11 ALARM DEFINITIONS

The following is a listing of the Alarm definitions for this application. Note that the alarms will show up in the event log.
Number of Retries: 5 for alarms 1 through 9, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	C(19) < X	LOW BATTER	16.0	10.8	0.0	0
2	C(20) < X*S(20,F) or C(20) > Y*S(20,F)	METR PRES	6900	0.0	1.01	0
3*	C(21) < X*S(21,F) or C(21) > Y*S(21,F)	AUX ANLG 3	-	0.0	1.01	0
4	C(22) < X*S(22,F) or C(22) > Y*S(22,F)	FLOW TEMP	66.0	0.0	1.01	0
5*	C(23) < X*S(23,F) or C(23) > Y*S(23,F)	DIFF PRES1	7.5	0.0	1.01	0
6	C(24) < X*S(24,F) or C(24) > Y*S(24,F)	DIFF PRES1	37.5	0.0	1.01	0
7*	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	LIVE SG (LV DENSITY)	50.0	0.0	1.01	0
8*	C(26) < X*S(26,F) or C(26) > Y*S(26,F)	LV ENERGY	45.0	0.0	1.01	0
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	99999999	0
10	C(30) <> 0.0	SYS ERROR	-	0.0	0.0	0

* This alarm should be disabled.

EXAMPLE:

Alarm # 2

Y	=	1.01
S(20,F)	=	The full-scale value for channel 20, which is the static pressure transmitter. SolarFlow Plus automatically generates this value based on the full-scale value entered while in the SETUP UNIT submenu.
F	=	6900 KPa

Therefore, the alarm setpoint for alarm #2 is 1.01(6900) = 6969 KPa.

When the ALARM menu is entered using the HHDT the user may modify the X, Y, or Z values shown in the above alarm conditions by changing the values for LOW, HIGH, and ALT. This enables the user to adjust the alarm limit(s) to match the requirements.

The value for X is represented by LOW on the HHDT ALARM SETUP menu. The value for Y is represented by HIGH on the HHDT ALARM SETUP menu. The value for Z is represented by ALT on the HHDT ALARM SETUP menu.

The ALARM menu is also used to acknowledge alarms and to activate or deactivate alarms.

To acknowledge an alarm condition displayed on the LCD of SolarFlow Plus, enter the ALARM menu of the HHDT and select the ACKNOWLEDGE sub-menu. Any existing unacknowledged alarms are displayed and the HHDT prompts: "ACKNOWLEDGE ? Y/N". Press the ENTER key to acknowledge the alarm. Once this has been done and the user has logged off SolarFlow Plus the activated alarm is displayed with the message "ACKNOWLEDGED" following the alarm condition. If the alarm condition no longer exists and has not been acknowledged it remains on the LCD until acknowledged.

To activate or deactivate alarms, enter the HHDT ALARM menu and select the SETUP sub-menu. The HHDT displays the various alarms that are available in the program. Scroll to the desired alarm and press the ENTER key at the desired alarm condition. The HHDT provides four options; STAT, LOW, HIGH, and ALT. Press ENTER at the STAT option. The HHDT shows either ON or OFF and prompts OK?. To turn off the alarm, press the NO key until OFF is displayed, then press ENTER.

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ISO - 5167V STACKED DUAL ORIFICE APPLICATION

8.0 STACKED DUAL ORIFICE APPLICATION

Section 8 covers the individual requirements for the ISO-5167V stacked dual orifice application (SDUAL ISO-5167V) configured to calculate mass and volumetric flow rate using equations from ISO-5167:1991. The stacked dual orifice application supports measurement on two meter tubes with stacked differential pressure transmitters on the primary meter. Optional capabilities such as valve positioning, chromatograph inputs, etc. are listed as part of the setup. If you do not need some of these capabilities, they may be skipped when entering the setup parameters with the Handheld Data Terminal (HHDT). Channels 1 and 2 are digital inputs which indicate whether an analog input is used for live density and energy respectively. To select fixed values, these inputs should be jumpered to ground; for live values, the inputs should be left open. Analog inputs use channels 19 through 26. Any unused analog input should be jumpered to ground.

When the SolarFlow Plus is configured for a new application, all channels are set to default values, and the Alarm definitions, Log definition, User Report list, and Analog Input channels are set to the values corresponding to the configuration chosen. The event log remains intact, but the data log is emptied.

8.1 FIELD WIRING CONNECTIONS

Before exchanging your EPROM set for working installations, make sure that all previous data is recorded as needed. Make sure that your slide switch settings are set in accordance with the information in section 1.13. No changes should be required unless the previously used application has been significantly different. Configurations for this application include the static pressure and DP transmitter(s) associated with meter 1 installed within the Model 2470 enclosure with all other transmitters installed externally, or with *all* transmitters installed externally.

The wiring configuration for the stacked dual orifice analog inputs is shown in this section.

A field wiring diagram is provided in the Model 2470 System Reference Manual. The following information furnishes necessary details for wiring both internal and external transmitters.

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
20	INTERNAL, static pressure (factory installed)	White (Blue*) Green (Black*) Black (Red*)	23 26 25	Signal in + Analog ground 8 to 10 VDC
*	SolarFlow Plus units fitted with Statham 36PG series static pressure transmitters are wired with the blue, black, and red wires.			
		or		
20	EXTERNAL, static pressure (to be installed by user)	Blue Black Red Shield	23 26 25 24	Signal in + Analog ground 8 to 10 VDC Earth ground
21	EXTERNAL, LV DENSITY (1)(2) (to be installed by user)	Blue Black Red Shield	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	EXTERNAL, temperature (to be installed by user)	Blue Black Red Shield	31 34 33 32	Signal in + Analog ground 8 to 10 VDC Earth ground
23	INTERNAL, differential pressure low (DP) No. 1 (factory installed)	Violet Black Gray	35 38 37	Signal in + Analog ground 8 to 10 VDC
		or		
23	EXTERNAL, differential pressure low (DP) No. 1 (to be installed by user)	Blue Black Red Shield	35 38 37 36	Signal in + Analog ground 8 to 10 VDC Earth ground
24	EXTERNAL, DP high No.1 (to be installed by user)	Blue Black Red Shield	39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
25	EXTERNAL, DIFF PRES2 (to be installed by user)		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	EXTERNAL, LV ENERGY (to be installed by user)		47 50 49 48	Signal in + Analog ground 8 to 10 VDC Earth ground

NOTES:

(1) Since fixed values are normally desired for density and energy, digital input channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 59 and 60, 52 and 61 on the rear termination board. The fixed values for heat value and specific gravity are entered in the GAS DATA submenu of the SETUP UNIT menu by keying in the desired value. Refer to the System Wiring Diagram.

(2) Wire for connecting the external transmitter inputs is user-supplied.

(3) Jumper any unused analog input to analog ground.

8.2 STATUS SIGNAL CONNECTIONS

This application supports status inputs that are activated by a dry contact closure between the status input pin number and common.

8.2.1 INPUTS

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
1	Live or fixed density	LV DENSITY	60 59 (GND)	Open, means use live density Shorted, means calculate density
2	Live or fixed energy	LV ENERGY	61 52 (GND)	Open, means use live energy Shorted, means use fixed energy
18	Chromatograph option	CHROM	68 58 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

	CH 1	CH 2	CH 18
Live SG and HV	No jumper	No jumper	No jumper
Fixed SG and HV	Jumper/GND	Jumper/GND	No jumper
Serial Chromatograph	Jumper/GND	Jumper/GND	Jumper/GND

Note that serial chromatograph inputs require that SG and HV be jumpered to ground as if fixed.

8.2.2 OUTPUTS

NOTE: All output signals from a SolarFlow Plus unit installed in a hazardous location must be isolated by means of intrinsic safety barriers.

This application has two form-A relays (mounted on the SolarFlow Plus PC board) that provide digital outputs for corrected station volume on Channels 5 and 6. The volume per pulse and the pulse period of the relays may be changed using the HHDT. Prompts for changing the relay volume per pulse (VPP1 and VPP2) and pulse period (PP1 and PP2) are included in the discussion of the CONTROL submenu of the SETUP UNIT menu, section 8.4.7.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	15 16	Form-A relay Common
6	Volume pulse output 2	VP2	17 18	Form-A relay Common

TTL level outputs for the following channels are available at the termination board pin numbers shown in the following table.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	78 76	TTL Output Common
6	Volume pulse output 2	VP2	79 77	TTL Output Common
7	Valve control open	OPEN 2	80 75	TTL Output Common
8	Valve control close	CLOSE 2	81 74	TTL Output Common

8.2.3 ANALOG OUTPUT CONNECTIONS

This application provides one 1-5 VDC analog output.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
27	Flow rate output	FLW RT OUT	3 4	Analog output 1 Ground
28	Valve positioning	VALVE POS	1 2	Analog output 2 Ground

8.2.4 CHROMATOGRAPH INTER-CONNECTIONS

For more detail in wiring the Model 2252 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 systems Reference Manual.

MODEL 2252	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out Serial in Ground	102 103 106	DI in DI out DI ground

8.3 SETUP LOCATION MENU

The SolarFlow Plus operating parameters for the ISO-5167V stacked dual orifice application that can be changed in the SETUP LOCATION menu are shown in the following table described by the HHDT prompt for the parameter, the factory-installed default value, and a blank space for entering the desired value if different from the factory default. Additional information on the SETUP LOCATION menu is provided in section 5.10.1 of the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT	DESIRED
LOC NAME	BLANK LOCATION	_____
LOC ID	0	_____
DATE	010180 MMDDYY	_____
WEEK DAY	1 (1-7)	_____
TIME	0000 HHMM	_____
SEC CODE(1)	120	_____
USER REP(2)	****	_____
PCOMM RATE(3)	300 BPS	_____
RTS DELAY(4)	0 1/100s	_____

NOTES:

(1) Refer to section 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.

(2) Refer to section 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt. Refer to section 8.8, this manual, for default listing.

(3) Refer to section 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.

(4) Refer to section 5.10.1.9 in the Model 2470 System Reference Manual for a complete discussion of the RTS DELAY prompt.

8.4 SETUP UNIT MENU

The parameters for the ISO-5167V stacked dual orifice application of SolarFlow Plus that can be changed in the submenus of the SETUP UNIT menu using the HHDT are tabulated as follows. The SETUP MENU has eight submenus: GENERAL, ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, AND CALC DATA. The parameters are tabulated by the HHDT prompt for the parameter, the factory-installed default, and a blank space for entering the desired value if different from the factory default.

8.4.1 GENERAL SUBMENU

The following parameters can be changed in the GENERAL submenu of the SETUP UNIT menu of the HHDT.

HHDT PROMPT	DEFAULT	DESIRED
UNIT NAME	BLANK UNIT	_____
UNIT ID	BLANK-ID	_____
CONTRCT HR	7 (0-23)	_____
LOG INTRVL	1 HOUR	_____
LOG DEFINE(1)		_____
RESET CMOD(2)	OFF	_____

NOTES:

(1) All data logs in the SolarFlow Plus memory are automatically erased and can no longer be recovered any time a change is made in the LOG DEFINE menu. Refer to section 1.9 for a description of the LOG DEFINE prompt. Refer to section 8.9 for default listing.

(2) The RESET CMOD (Reset Calculations Module) prompt selects the calculation module for an alternate SolarFlow Plus application. RESET CMOD is discussed in detail in section 5.10.2.1.6 in the Model 2470 SolarFlow Plus System Reference Manual.

8.4.2 ANALOGS SUBMENU

The ANALOGS submenu of the SETUP UNIT menu of the ISO-5167V stacked dual orifice application provides for toggling between LIVE and FIXED values of the following analog inputs. The AUX1 key on the HHDT toggles the input between the fixed and live values. A fixed value is shown by an asterisk (*) following the analog value in the HHDT display. For additional information, refer to the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT
METR PRES	xxxxx KPa
METR TEMP	xxxxx DEG C
DIFF PRESL	xxxxx KPa
DIFF PRESH	xxxxx KPa
DIFF PRES2	xxxxx KPa
LV DENSITY	xxxxx Kg/M3
BATTERY	xxxxx VOLTS
LV ENERGY	xxxxx MJ/M3
FLW RT OUT	xxxxx M3/HR
VALVE POS	xxxxx %

8.4.3 SCALES SUBMENU

The high- and low-scale setpoints for the analog inputs shown in the following table can be modified in the SCALES submenu of the SETUP UNIT menu. Refer to section 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

HHDT PROMPT	DEFAULT		DESIRED
M PRES/LO	0.0	KPa	_____
M PRES/HI	6900.0	KPa	_____
M TEMP/LO	-18.0	DEG C	_____
M TEMP/HI	66.0	DEG C	_____
D PRESL/LO	0.0	KPa	_____
D PRESL/HI	7.50	KPa	_____
D PRESH/LO	0.0	KPa	_____
D PRESH/HI	37.50	KPa	_____
D PRES2/LO	0.0	KPa	_____
D PRES2/HI	37.50	KPa	_____
DENSITY LO	0.0	Kg/M3	_____
DENSITY HI	100.0	Kg/M3	_____
ENERGY LO*	0.0	MJ/M3	_____
ENERGY HI*	100.0	MJ/M3	_____
FLW RT LOW	0	M3/HR	_____
FLW RT HI	50000	M3/HR	_____
VLV POS LO	0.0	%	_____
VLV POS HI	100.0	%	_____

* Shows LIVE input; if the input is FIXED, ENERGY/LO will read 0.0 MJ/M3 and ENERGY/HI will read 100.0 MJ/M3.

8.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
OPEN 2	ON
CLOSE 2	OFF
OPEN 3 *	ON
CLOSE 3 *	OFF
OUTPUT 13	OFF
OUTPUT 14	OFF
OUTPUT 15	OFF

* Not used for this application.

8.4.5 CONFIG SUBMENU

The following default parameters can be changed in the CONFIG submenu of the SETUP UNIT menu. Refer to section 5.10.2.4 in the Model 2470 System Reference Manual for additional information about the CONFIG submenu.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
ORIF DIAM1	100.0	MM	_____
PIPE DIAM1	200.0	MM	_____
ZFLOW LIM1	0.10	KPa	_____
TAP LCTN 1	0		_____
TAP TYPE 1	0		_____
ORIF DIAM2	100.0	MM	_____
PIPE DIAM2	200.0	MM	_____
ZFLOW LIM2	0.10	KPa	_____
TAP LCTN 2	0		_____
TAP TYPE 2	0		_____
ATMS PRES	101.325	KPa	_____
PRES BASE	101.325	KPa	_____
TEMP BASE	15.0	DEG C	_____
AGA8 MTHD	0		_____
SG SELECT	1		_____
ORIF MTRL	1		_____
PIPE MTRL	0		_____
TREF ORIF	20.0	DEG C	_____
TREF PIPE	20.0	DEG C	_____
CHROM ADDR	1		_____
CHROM STRM	1		_____
VERSION	2.4		_____

8.4.6 GAS DATA

This ISO-5167V SolarFlow Plus software can accept information from the Model 2252 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 59 on the termination board. In addition, the MODBUS communication address and the chromatograph stream No. desired must be programmed in by the HHDT (CONFIG submenu). The Solarflow Plus will then poll the chromatograph once every four minutes automatically. Refer to section 1.5.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
SPEC GRAV	0.6000		_____
HEAT VALUE	36.251	MJ/M3	_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
VISCOSITY	0.010268	cP	_____
SPEC HEAT	1.30		_____
METHANE	95.000	MOL%	_____
ETHANE	5.000	MOL%	_____
PROPANE	0.000	MOL%	_____
H2O	0.000	MOL%	_____
H2S	0.000	MOL%	_____
HYDROGEN	0.000	MOL%	_____
CO	0.000	MOL%	_____
OXYGEN	0.000	MOL%	_____
I-BUTANE	0.000	MOL%	_____
BUTANE	0.000	MOL%	_____
I-PENTANE	0.000	MOL%	_____
PENTANE	0.000	MOL%	_____
HEXANE	0.000	MOL%	_____
HEPTANE	0.000	MOL%	_____
OCTANE	0.000	MOL%	_____
NONANE	0.000	MOL%	_____
DECANE	0.000	MOL%	_____
HELIUM	0.000	MOL%	_____
ARGON	0.000	MOL%	_____

8.4.7 CONTROL SUBMENU

The CONTROL submenu of the SETUP UNIT menu provides for entering the control values primarily for the valve positioning and tube switching. Refer to sections 1.6 and 1.7 for more information.

HHDT PROMPT	DEFAULT		DESIRED
VPP 1	1000	M^3	_____
PP 1	1	SEC	_____
VPP 2	1000	M^3	_____
PP 2	1	SEC	_____
TS ENABLE	0		_____
OPEN 2 SP	25.00	KPa	_____
CLOSE 2 SP	5.00	KPa	_____
TS DELAY	30	SECS	_____
TS VLV TIM	30	SECS	_____
VP MODE	0		_____
FLW SETPNT	0	M3/HR	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5	%	_____
PRES CHAN#	20		_____
OVRD PRESS	0	KPa	_____
DP LIMIT	0	KPa	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALVE POS	50.0	%	_____

8.4.8 CALCULATED DATA

The CALC DATA submenu of the SETUP UNIT menu allows the user to determine the calculated values for specified application inputs. The values shown here are typical values and not default values.

HHDT PROMPT	SAMPLE VALUES	
AGA8 MTHD	0	
ZS	0.997811	
DENSITY-B	0.8050	Kg/M3
FLOW RATE1	0	M3/HR
FLOW RATE1	0.00	TON/H
EV 1	1.03164	
CD 1	0.603166	
Y FCTR 1	0.999892	
FLW EXTN 1	94.841	
DENSITY-F1	5.327	Kg/M3
FLOW RATE2	0	M3/HR
FLOW RATE2	0.00	TON/H
EV 2	1.0000	
CD 2	0.600000	
Y FCTR 2	1.000000	
FLW EXTN 2	0.000	
DENSITY-F2	1.000000	Kg/M3
B - AGA8	0.033417	
C - AGA8	0.002236	
D - AGA8	0.266296	
K - AGA8	0.100912	
MOL WT.	16.7444	

8.5 DISPLAY MENU

The DISPLAY Menu of the HHDT provides for viewing the various setup parameters and calculated values in a SolarFlow Plus unit at any given time. The menu is for display purposes only. No changes can be made to the values displayed using this menu. The Display menu has eight selections: ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, CALC DATA and RATE/VOLS.

8.5.1 ANALOGS

METR PRES	(KPa)
METR TEMP	(DEG C)
DIFF PRESL	(KPa)
DIFF PRESH	(KPa)
DIFF PRES2	(KPa)
LV DENSITY	(Kg/M3)
BATTERY	(VOLTS)
LV ENERGY	(MJ/M3)
FLW RT OUT	(M3/HR)
VALVE POS	(%)

8.5.2 SCALES

M PRES/LO	(KPa)	FLW RT LOW	(M3/HR)
M PRES/HI	(KPa)	FLW RT HI	(M3/HR)
M TEMP/LO	(DEG C)	VLV POS LO	(%)
M TEMP/HI	(DEG C)	VLV POS HI	(%)
D PRESL/LO	(KPa)		
D PRESL/HI	(KPa)		
D PRESH/LO	(KPa)		
D PRESH/HI	(KPa)		
D PRES2/LO	(KPa)		
D PRES2/HI	(KPa)		
DENSITY LO	(Kg/M3)		
DENSITY HI	(Kg/M3)		
ENERGY LO	(MJ/M3)		
ENERGY HI	(MJ/M3)		

8.5.3 DISCRETES

LV DENSITY	OPEN 3
LV ENERGY	CLOSE 3
CHROM	OUTPUT 13
VP 1	OUTPUT 14
VP 2	OUTPUT 15
OPEN 2	
CLOSE 2	
INPUT 3	
INPUT 4	
INPUT 9	
INPUT 10	
INPUT 16	
INPUT 17	

8.5.4 CONFIG

ORIF DIAM1	(MM)	SG SELECT	
PIPE DIAM1	(MM)	ORIF MTRL	
ZFLOW LIM1	(KPa)	PIPE MTRL	
TAP LCTN 1		TREF ORIF	(DEG C)
TAP TYPE 1		TREF PIPE	(DEG C)
ORIF DIAM2	(MM)	CHROM ADDR	
PIPE DIAM2	(MM)	CHROM STRM	
ZFLOW LIM2	(KPa)	VERSION	
TAP LCTN 2			
TAP TYPE 2			
ATMS PRES	(KPa)		
PRES BASE	(KPa)		
TEMP BASE	(DEG C)		
AGA8 MTHD			

8.5.5 GAS DATA

SPEC GRAV	
HEAT VALUE	(MJ/M3)
CO2	(MOL%)
N2	(MOL%)
VISCOSITY	(cP)
SPEC HEAT	
METHANE	(MOL%)
ETHANE	(MOL%)
PROPANE	(MOL%)
H20	(MOL%)
H2S	(MOL%)
HYDROGEN	(MOL%)
CO	(MOL%)
OXYGEN	(MOL%)
I-BUTANE	(MOL%)
BUTANE	(MOL%)
I-PENTANE	(MOL%)
PENTANE	(MOL%)
HEXANE	(MOL%)
HEPTANE	(MOL%)
OCTANE	(MOL%)
NONANE	(MOL%)
DECANE	(MOL%)
HELIUM	(MOL%)
ARGON	(MOL%)

8.5.6 CONTROL

VPP 1	(M^3)
PP 1	(SEC)
VPP 2	(M^3)
PP 2	(SEC)
TS ENABLE	
OPEN 2 SP	(KPa)
CLOSE 2 SP	(KPa)
TS DELAY	(SECS)
TS VLV TIM	(SECS)
VP MODE	
FLW SETPNT	(M3/HR)
DEADBAND	(%)
SMALL STEP	(%)
LARGE STEP	(%)
FINE CNTRL	(%)
PRES CHAN#	
OVRD PRESS	(KPa)
DP LIMIT	(KPa)
PRESET POS	(%)
UPDATE TIM	(SECS)
VALVE POS	(%)

8.5.7 CALC DATA

AGA8 MTHD	
ZS	
DENSITY-B	(Kg/m3)
FLOW RATE1	(M3/HR)
FLOW RATE1	(TON/H)
EV 1	
CD 1	
Y FCTR 1	
FLW EXTN 1	
DENSITY-F1	(Kg/M3)
FLOW RATE2	(M3/HR)
FLOW RATE2	(TON/H)
EV 2	
CD 2	
Y FCTR 2	
FLW EXTN 2	
DENSITY-F2	(Kg/M3)
B - AGA8	
C - AGA8	
D - AGA8	
K - AGA8	
MOL WT.	

8.5.8 RATE/VOLS

FLOW RATE1	(M3/HR)
FLOW RATE1	(M3/DY)
TODAY VOL1	(M^3)
YSDAY VOL1	(M^3)
TOT VOL 1	(M^3)
FLOW RATE2	(M3/HR)
FLOW RATE2	(M3/DY)
TODAY VOL2	(M^3)
YSDAY VOL2	(M^3)
TOT VOL 2	(M^3)
STN FLW RT	(M3/HR)
STN FLW RT	(M3/DY)
ST TDY VOL	(M^3)
ST YSY VOL	(M^3)
ST TOT VOL	(M^3)
ERATE 1	(GJ/HR)
TDY ENRGY1	(GJ)
YSY ENRGY1	(GJ)
TOT ENRGY1	(GJ)
ERATE 2	(GJ/HR)
TDY ENRGY2	(GJ)
YSY ENRGY2	(GJ)
TOT ENRGY2	(GJ)
STN ERATE	(GJ/HR)
TDY ENERGY	(GJ)
YSY ENERGY	(GJ)
TOT ENERGY	(GJ)
FLOW RATE1	(TON/H)
TODAY VOL1	(TONS)
YSDAY VOL1	(TONS)
TOT VOL 1	(TONS)
FLOW RATE2	(TON/H)
TODAY VOL2	(TONS)
YSDAY VOL2	(TONS)
TOT VOL 2	(TONS)
STN FLW RT	(TON/H)
ST TDY VOL	(TONS)
ST YSY VOL	(TONS)
ST TOT VOL	(TONS)

8.6 CALIBRATE UNIT MENU

The CALIBRATE UNIT menu provides for calibrating the SolarFlow Plus input circuitry to match the outputs of the transmitters for analog inputs to the SolarFlow Plus unit. The CALIBRATE UNIT menu has three selections: PRESSURES, TEMP and OTHERS. Refer to section 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

8.6.1 PRESSURES

The PRESSURES selection of the CALIBRATE UNIT menu provides for calibrating the pressure inputs listed as follows:

METR PRES
DIFF PRESL
DIFF PRESH
DIFF PRES2.

8.6.2 TEMPERATURE

The TEMP selection of the CALIBRATE UNIT menu provides for calibrating the METR TEMP selection.

8.6.3 OTHERS

The analog inputs listed as follows are calibrated in the OTHERS submenu of the CALIBRATE UNIT MENU:

LV DENSITY
LV ENERGY.

8.7 MONITOR MENU

The MONITOR menu provides for witness testing analog inputs to the SolarFlow Plus unit. When the MONITOR menu is entered, all analog inputs are fixed at the values being transmitted to SolarFlow Plus when MONITOR is executed. The values remain fixed until the MONITOR menu is exited. Refer to section 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES	DIFF PRES2
METR TEMP	LV DENSITY
DIFF PRESL	LV ENERGY
DIFF PRESH	

8.8 USER REPORT (CHANNEL 0)

Channel zero (0) is a predefined report list containing a report header and the channel data shown in the following table. The SolarFlow Plus unit displays the Users Report on the front panel in a scrolling format. Refer to section 8.3, "USER REP".

CHANNEL NUMBER	CHANNEL LABEL	DESCRIPTION
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in KPa
032	COMP DPRES	Composite DP, Run No.1, value in kilopascals
025	DIFF PRES2	Live DP, Run No.2, value in kilopascals
022	FLOW TEMP1	Live temperature in degrees Celsius (ºC)
021	AUX ANLG 3 (LV DENSITY)	Live value for density
134	FLOW RATE1	Flow rate for meter No.1
139	TOT VOL 1	Total volume for meter No.1
164	FLOW RATE2	Flow rate for meter No.2
169	TOT VOL 2	Total volume for meter No.2
213	ST TDY VOL	Station today's volume
214	YSDAY VOL	Station yesterday's volume

8.9 DATA LOG LIST CONTENTS

The following are default items included on the data log. Refer to section 8.4.1, "LOG DEFINE". The data log is set to a 1-hour log interval. The default contract hour is 7:00 AM.

CHANNEL NUMBER	CHANNEL LABEL	DECIMAL PLACES	DIGITS	LOGGING TYPE
032	COMP DPRES	2	6	AVERAGE
020	METR PRES	1	6	AVERAGE
022	FLW TEMP	1	4	AVERAGE
133	FLW TIME 1	1	6	SNAPSHOT & ZERO
132	FLW EXTN 1	3	6	AVERAGE
136	LOG VOL1	0	8	SNAPSHOT & ZERO
146	LOG VOL1	2	6	SNAPSHOT & ZERO
025	DIFF PRES2	2	6	AVERAGE
163	FLW TIME 2	1	6	SNAPSHOT & ZERO
162	FLW EXTN 2	3	6	AVERAGE
166	LOG VOL2	0	8	SNAPSHOT & ZERO
176	LOG VOL2	2	6	SNAPSHOT & ZERO

8.10 DATA LOG HEADER BLOCK CONTENTS

The data log header block includes the following items for use on data log:

M PRES/LO
M PRES/HI
M TEMP/LO
M TEMP/HI
D PRESL/LO
D PRESL/HI
D PRESH/LO
D PRESH/HI
D PRES2/LO
D PRES2/HI
ORIF DIAM1
PIPE DIAM1

(Continued on the next page)

Data Log Header Block (Continued)

ZFLOW LIM1	HEPTANE
TAP LCTN 1	OCTANE
TAP TYPE 1	NONANE
ORIF DIAM2	DECANE
PIPE DIAM2	HELIUM
ZFLOW LIM2	ARGON
TAP LCTN 2	
TAP TYPE 2	
ATMS PRES	
PRES BASE	
TEMP BASE	
AGA8 MTHD	
SG SELECT	
ORIF MTRL	
PIPE MTRL	
TREF ORIF	
TREF PIPE	
SPEC GRAV	
HEAT VALUE	
CO2	
N2	
VISCOSITY	
SPEC HEAT	
METHANE	
ETHANE	
PROPANE	
H2O	
H2S	
HYDROGEN	
CO	
OXYGEN	
I-BUTANE	
BUTANE	
I-PENTANE	
PENTANE	
HEXANE	

8.11 ALARM DEFINITIONS

The following is a listing of the Alarm definitions for this application. Note that the alarms will show up in the event log.
Number of Retries: 5 for alarms 1 through 9, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	C(19) < X	LOW BATTER	16.0	10.8	0.0	0
2	C(20) < X*S(20,F) or C(20) > Y*S(20,F)	METR PRES	6900	0.0	1.01	0
3*	C(21) < X*S(21,F) or C(21) > Y*S(21,F)	LIVE SG (LV DENSITY)	-	0.0	1.01	0
4	C(22) < X*S(22,F) or C(22) > Y*S(22,F)	FLOW TEMP	66.0	0.0	1.01	0
5*	C(23) < X*S(23,F) or C(23) > Y*S(23,F)	DIFF PRES1	7.5	0.0	1.01	0
6	C(24) < X*S(24,F) or C(24) > Y*S(24,F)	DIFF PRES1	37.5	0.0	1.01	0
7	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	DIFF PRES2	37.5	0.0	1.01	0
8*	C(26) < X*S(26,F) or C(26) > Y*S(26,F)	LV ENERGY	45.0	0.0	1.01	0
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	99999999	0
10	C(30) <> 0.0	SYS ERROR	-	0.0	0.0	0

* This alarm should be disabled.

EXAMPLE:

Alarm # 2

Y	=	1.01
S(20,F)	=	The full-scale value for channel 20, which is the static pressure transmitter. SolarFlow Plus automatically generates this value based on the full-scale value entered while in the SETUP UNIT submenu.
F	=	6900 KPa

Therefore, the alarm setpoint for alarm #2 is 1.01(6900) = 6969 KPa.

When the ALARM menu is entered using the HHDT the user may modify the X, Y, or Z values shown in the above alarm conditions by changing the values for LOW, HIGH, and ALT. This enables the user to adjust the alarm limit(s) to match the requirements.

The value for X is represented by LOW on the HHDT ALARM SETUP menu. The value for Y is represented by HIGH on the HHDT ALARM SETUP menu. The value for Z is represented by ALT on the HHDT ALARM SETUP menu.

The ALARM menu is also used to acknowledge alarms and to activate or deactivate alarms.

To acknowledge an alarm condition displayed on the LCD of SolarFlow Plus, enter the ALARM menu of the HHDT and select the ACKNOWLEDGE sub-menu. Any existing unacknowledged alarms are displayed and the HHDT prompts: "ACKNOWLEDGE ? Y/N". Press the ENTER key to acknowledge the alarm. Once this has been done and the user has logged off SolarFlow Plus the activated alarm is displayed with the message "ACKNOWLEDGED" following the alarm condition. If the alarm condition no longer exists and has not been acknowledged it remains on the LCD until acknowledged.

To activate or deactivate alarms, enter the HHDT ALARM menu and select the SETUP sub-menu. The HHDT displays the various alarms that are available in the program. Scroll to the desired alarm and press the ENTER key at the desired alarm condition. The HHDT provides four options; STAT, LOW, HIGH, and ALT. Press ENTER at the STAT option. The HHDT shows either ON or OFF and prompts OK?. To turn off the alarm, press the NO key until OFF is displayed, then press ENTER.

ISO - 5167V STACKED TRIPLE ORIFICE APPLICATION

9.0 STACKED TRIPLE ORIFICE APPLICATION

Section 9 covers the individual requirements for the ISO-5167V stacked triple orifice application (STRIP ISO-5167V) configured to calculate mass and volumetric flow rate using equations from ISO-5167:1991. The stacked triple orifice application supports measurement on three meter tubes with stacked differential pressure transmitters on the primary meter. Optional capabilities such as valve positioning, chromatograph inputs, etc. are listed as part of the setup. If you do not need some of these capabilities, they may be skipped when entering the setup parameters with the Handheld Data Terminal (HHDT). Channels 1 and 2 are digital inputs which indicate whether an analog input is used for live density and energy respectively. To select fixed values, these inputs should be jumpered to ground; for live values, the inputs should be left open. Analog inputs use Channels 19 through 26. Any unused analog input should be jumpered to ground.

When the SolarFlow Plus is configured for a new application, all channels are set to default values, and the Alarm definitions, Log definition, User Report list, and Analog Input channels are set to the values corresponding to the configuration chosen. The event log remains intact, but the data log is emptied.

9.1 FIELD WIRING CONNECTIONS

Before exchanging your EPROM set for working installations, make sure that all previous data is recorded as needed. Make sure that your slide switch settings are set in accordance with the information in section 1.13. No changes should be required unless the previously used application has been significantly different. Configurations for this application include the static pressure and DP transmitter(s) associated with meter 1 installed within the Model 2470 enclosure with all other transmitters installed externally, or with *all* transmitters installed externally.

The wiring configuration for the stacked dual orifice analog inputs is shown in this section.

A field wiring diagram is provided in the Model 2470 System Reference Manual. The following information furnishes necessary details for wiring both internal and external transmitters.

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
20	INTERNAL, static pressure (factory installed)	White (Blue*) Green (Black*) Black (Red*)	23 26 25	Signal in + Analog ground 8 to 10 VDC
*	SolarFlow Plus units fitted with Statham 36PG series static pressure transmitters are wired with the blue, black, and red wires.			
	or			
20	EXTERNAL, static pressure [2] (to be installed by user)	Blue Black Red Shield	23 26 25 24	Signal in + Analog ground 8 to 10 VDC Earth ground
21	EXTERNAL, temperature (to be installed by user)	Blue Black Red Shield	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	EXTERNAL, DP No.1 low (to be installed by user)	Blue Black Red Shield	31 34 33 32	Signal in + Analog ground 8 to 10 VDC Earth ground
23	INTERNAL, differential pressure high (DP) No. 1 (factory installed)	Violet Black Gray	35 38 37	Signal in + Analog ground 8 to 10 VDC
	or			
23	EXTERNAL, differential pressure high (DP) No.1 (to be installed by user)	Blue Black Red Shield	35 38 37 36	Signal in + Analog ground 8 to 10 VDC Earth ground
24	EXTERNAL, DP No. 2, (to be installed by user)	Blue Black Red Shield	39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
25	EXTERNAL, DP No.3 (to be installed by user)		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	EXTERNAL, LV DENSITY (1) (2) (to be installed by user)		47 50 49 48	Signal in + Analog ground 8 to 10 VDC Earth ground

NOTES:

(1) Since fixed values are normally desired for density and energy, digital input channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 59 and 60, 52 and 61 on the rear termination board. The fixed values for heat value and specific gravity are entered in the GAS DATA submenu of the SETUP UNIT menu by keying in the desired value. Refer to the System Wiring Diagram.

(2) Wire for connecting the external transmitter inputs is user-supplied.

(3) Jumper any unused analog input to analog ground.

9.2 STATUS SIGNAL CONNECTIONS

This application supports status inputs that are activated by a dry contact closure between the status input pin number and common.

9.2.1 INPUTS

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
1	Live or fixed density	LV DENSITY	60 59 (GND)	Open, means use live density Shorted, means calculate density
2	Live or fixed energy	LV ENERGY	61 52 (GND)	Open, means use live energy Shorted, means use fixed energy
18	Chromatograph option	CHROM	68 58 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

	CH 1	CH 2	CH 18
Live SG and HV	No jumper	No jumper	No jumper
Fixed SG and HV	Jumper/GND	Jumper/GND	No jumper
Serial Chromatograph	Jumper/GND	Jumper/GND	Jumper/GND

Note that serial chromatograph inputs require that SG and HV be jumpered to ground as if fixed.

9.2.2 OUTPUTS

NOTE: All output signals from a SolarFlow Plus unit installed in a hazardous location must be isolated by means of intrinsic safety barriers.

This application has two form-A relays (mounted on the SolarFlow Plus PC board) that provide digital outputs for corrected station volume on Channels 5 and 6. The volume per pulse and the pulse period of the relays may be changed using the HHDT. Prompts for changing the relay volume per pulse (VPP1 and VPP2) and pulse period (PP1 and PP2) are included in the discussion of the CONTROL submenu of the SETUP UNIT menu, section 9.4.7.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	15 16	Form-A relay Common
6	Volume pulse output 2	VP2	17 18	Form-A relay Common

TTL level outputs for the following channels are available at the termination board pin numbers shown in the following table.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	78 76	TTL Output Common
6	Volume pulse output 2	VP2	79 77	TTL Output Common
7	Valve control open	OPEN 2	80 75	TTL Output Common
8	Valve control close	CLOSE 2	81 74	TTL Output Common
11	Valve control open	OPEN 3	82 73	TTL Output Common
12	Valve control close	CLOSE 3	83 72	TTL Output Common

9.2.3 ANALOG OUTPUT CONNECTIONS

This application provides one 1-5 VDC analog output.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
27	Flow rate output	FLW RT OUT	3 4	Analog output 1 Ground
28	Valve positioning	VALVE POS	1 2	Analog output 2 Ground

9.2.4 CHROMATOGRAPH INTER-CONNECTIONS

For more detail in wiring the Model 2252 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 systems Reference Manual.

MODEL 2252	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out Serial in Ground	102 103 106	DI in DI out DI ground

9.3 SETUP LOCATION MENU

The SolarFlow Plus operating parameters for the ISO-5167V stacked triple orifice application that can be changed in the SETUP LOCATION menu are shown in the following table described by the HHDT prompt for the parameter, the factory-installed default value, and a blank space for entering the desired value if different from the factory default. Additional information on the SETUP LOCATION menu is provided in section 5.10.1 of the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT	DESIRED
LOC NAME	BLANK LOCATION	_____
LOC ID	0	_____
DATE	010180 MMDDYY	_____
WEEK DAY	1 (1-7)	_____
TIME	0000 HHMM	_____
SEC CODE(1)	120	_____
USER REP(2)	****	_____
PCOMM RATE(3)	300 BPS	_____
RTS DELAY(4)	0 1/100s	_____

NOTES:

(1) Refer to section 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.

(2) Refer to section 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt. Refer to section 9.8, this manual, for default listing.

(3) Refer to section 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.

(4) Refer to section 5.10.1.9 in the Model 2470 System Reference Manual for a complete discussion of the RTS DELAY prompt.

9.4 SETUP UNIT MENU

The parameters for the ISO-5167V stacked triple orifice application of SolarFlow Plus that can be changed in the submenus of the SETUP UNIT menu using the HHDT are tabulated as follows. The SETUP MENU has eight submenus: GENERAL, ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, AND CALC DATA. The parameters are tabulated by the HHDT prompt for the parameter, the factory-installed default, and a blank space for entering the desired value if different from the factory default.

9.4.1 GENERAL SUBMENU

The following parameters can be changed in the GENERAL submenu of the SETUP UNIT menu of the HHDT.

HHDT PROMPT	DEFAULT	DESIRED
UNIT NAME	BLANK UNIT	_____
UNIT ID	BLANK-ID	_____
CONTRCT HR	7 (0-23)	_____
LOG INTRVL	1 HOUR	_____
LOG DEFINE(1)		_____
RESET CMOD(2)	OFF	_____

NOTES:

(1) All data logs in the SolarFlow Plus memory are automatically erased and can no longer be recovered any time a change is made in the LOG DEFINE menu. Refer to section 1.9 for a description of the LOG DEFINE prompt. Refer to section 9.9 for default listing.

(2) The RESET CMOD (Reset Calculations Module) prompt selects the calculation module for an alternate SolarFlow Plus application. RESET CMOD is discussed in detail in section 5.10.2.1.6 in the Model 2470 SolarFlow Plus System Reference Manual.

9.4.2 ANALOGS SUBMENU

The ANALOGS submenu of the SETUP UNIT menu provides for toggling between LIVE and FIXED values of the following analog inputs. The AUX1 key on the HHDT toggles the input between the fixed and live values. A fixed value is shown by an asterisk (*) following the analog value in the display. For additional information, refer to the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT
METR PRES	xxxxx KPa
METR TEMP	xxxxx DEG C
DIFF PRESL	xxxxx KPa
DIFF PRESH	xxxxx KPa
DIFF PRES2	xxxxx KPa
DIFF PRES3	xxxxx KPa
LV DENSITY	xxxxx Kg/M3
BATTERY	xxxxx VOLTS
FLW RT OUT	xxxxx M3/HR
VALVE POS	xxxxx %

9.4.3 SCALES SUBMENU

The high- and low-scale setpoints for the analog inputs shown in the following table can be modified in the SCALES submenu of the SETUP UNIT menu. Refer to section 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

HHDT PROMPT	DEFAULT		DESIRED
M PRES/LO	0.0	KPa	_____
M PRES/HI	6900.0	KPa	_____
M TEMP/LO	-18.0	DEG C	_____
M TEMP/HI	66.0	DEG C	_____
D PRESL/LO	0.0	KPa	_____
D PRESL/HI	7.50	KPa	_____
D PRESH/LO	0.0	KPa	_____
D PRESH/HI	37.50	KPa	_____
D PRES2/LO	0.0	KPa	_____
D PRES2/HI	37.50	KPa	_____
D PRES3/LO	0.0	KPa	_____
D PRES3/HI	37.50	KPa	_____
DENSITY LO	0.0	Kg/M3	_____
DENSITY HI	100.0	Kg/M3	_____
FLW RT LOW	0	M3/HR	_____
FLW RT HI	50000	M3/HR	_____
VLV POS LO	0.0	%	_____
VLV POS HI	100.0	%	_____

9.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
OPEN 2	ON
CLOSE 2	OFF
OPEN 3	ON
CLOSE 3	OFF
OUTPUT 13	OFF
OUTPUT 14	OFF
OUTPUT 15	OFF

9.4.5 CONFIG SUBMENU

The following default parameters can be changed in the CONFIG submenu of the SETUP UNIT menu. Refer to section 5.10.2.4 in the Model 2470 System Reference Manual for additional information about the CONFIG submenu.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
ORIF DIAM1	100.0	MM	_____
PIPE DIAM1	200.0	MM	_____
ZFLOW LIM1	0.10	KPa	_____
TAP LCTN 1	0		_____
TAP TYPE 1	0		_____
ORIF DIAM2	100.0	MM	_____
PIPE DIAM2	200.0	MM	_____
ZFLOW LIM2	0.10	KPa	_____
TAP LCTN 2	0		_____
TAP TYPE 2	0		_____
ORIF DIAM3	100.0	MM	_____
PIPE DIAM3	200.0	MM	_____
ZFLOW LIM3	0.10	KPa	_____
TAP LCTN 3	0		_____
TAP TYPE 3	0		_____
ATMS PRES	101.325	KPa	_____
PRES BASE	101.325	KPa	_____
TEMP BASE	15.0	DEG C	_____
AGA8 MTHD	0		_____
SG SELECT	1		_____
ORIF MTRL	1		_____
PIPE MTRL	0		_____
TREF ORIF	20.0	DEG C	_____
TREF PIPE	20.0	DEG C	_____
CHROM ADDR	1		_____
CHROM STRM	1		_____
VERSION	2.4		_____

9.4.6 GAS DATA

This ISO-5167V SolarFlow Plus software can accept information from the Model 2252 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 59 on the termination board. In addition, the MODBUS communication address and the chromatograph stream No. desired must be programmed in by the HHDT (CONFIG submenu). The Solarflow Plus will then poll the chromatograph once every four minutes automatically. Refer to section 1.5.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
SPEC GRAV	0.6000		_____
HEAT VALUE	36.251	MJ/M3	_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
VISCOSITY	0.010268	cP	_____
SPEC HEAT	1.30		_____
METHANE	95.000	MOL%	_____
ETHANE	5.000	MOL%	_____
PROPANE	0.000	MOL%	_____
H2O	0.000	MOL%	_____
H2S	0.000	MOL%	_____
HYDROGEN	0.000	MOL%	_____
CO	0.000	MOL%	_____
OXYGEN	0.000	MOL%	_____
I-BUTANE	0.000	MOL%	_____
BUTANE	0.000	MOL%	_____
I-PENTANE	0.000	MOL%	_____
PENTANE	0.000	MOL%	_____
HEXANE	0.000	MOL%	_____
HEPTANE	0.000	MOL%	_____
OCTANE	0.000	MOL%	_____
NONANE	0.000	MOL%	_____
DECANE	0.000	MOL%	_____
HELIUM	0.000	MOL%	_____
ARGON	0.000	MOL%	_____

9.4.7 CONTROL SUBMENU

The CONTROL submenu of the SETUP UNIT menu provides for entering the control values primarily for the valve positioning and tube switching. Refer to sections 1.6 and 1.7 for more information.

HHDT PROMPT	DEFAULT		DESIRED
VPP 1	1000	M^3	_____
PP 1	1	SEC	_____
VPP 2	1000	M^3	_____
PP 2	1	SEC	_____
TS ENABLE	0		_____
OPEN 2 SP	25.00	KPa	_____
CLOSE 2 SP	5.00	KPa	_____
OPEN 3 SP	25.00	KPa	_____
CLOSE 3 SP	5.00	KPa	_____
TS DELAY	30	SECS	_____
TS VLV TIM	30	SECS	_____
VP MODE	0		_____
FLW SETPNT	0	M3/HR	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5	%	_____
PRES CHAN#	20		_____
OVRD PRESS	0	KPa	_____
DP LIMIT	0	KPa	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALVE POS	50.0	%	_____

9.4.8 CALCULATED DATA

The CALC DATA submenu of the SETUP UNIT menu allows the user to determine the calculated values for specified application inputs. The values shown here are typical values and not default values.

HHDT PROMPT	SAMPLE VALUES	
AGA8 MTHD	0	
ZS	0.997811	
DENSITY-B	0.8050	Kg/M3
FLOW RATE1	0	M3/HR
FLOW RATE1	0.00	TON/H
EV 1	1.03164	
CD 1	0.603166	
Y FCTR 1	0.999892	
FLW EXTN 1	94.841	
DENSITY-F1	5.327	Kg/M3
FLOW RATE2	0	M3/HR
FLOW RATE2	0.00	TON/H
EV 2	1.0000	
CD 2	0.600000	
Y FCTR 2	1.000000	
FLW EXTN 2	0.000	
DENSITY-F2	5.327	Kg/M3
FLOW RATE3	0	M3/HR
FLOW RATE3	0.00	TON/H
EV 3	1.03164	
CD 3	0.604273	
Y FCTR 3	1.000000	
FLW EXTN 3	24.495	
DENSITY-F3	5.327	Kg/M3
B - AGA8	0.033417	
C - AGA8	0.002236	
D - AGA8	0.266296	
K - AGA8	0.100912	
MOL WT.	16.7444	

9.5 DISPLAY MENU

The DISPLAY Menu of the HHDT provides for viewing the various setup parameters and calculated values in a SolarFlow Plus unit at any given time. The menu is for display purposes only. No changes can be made to the values displayed using this menu. The Display menu has eight selections: ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, CALC DATA, and RATE/VOLS.

9.5.1 ANALOGS

METR PRES	(KPa)
METR TEMP	(DEG C)
DIFF PRESL	(KPa)
DIFF PRESH	(KPa)
DIFF PRES2	(KPa)
DIFF PRES3	(KPa)
LV DENSITY	(Kg/M3)
BATTERY	(VOLTS)
FLW RT OUT	(M3/HR)
VALVE POS	(%)

9.5.2 SCALES

M PRES/LO	(KPa)	FLW RT LOW	(M3/HR)
M PRES/HI	(KPa)	FLW RT HI	(M3/HR)
M TEMP/LO	(DEG C)	VLV POS LO	(%)
M TEMP/HI	(DEG C)	VLV POS HI	(%)
D PRESL/LO	(KPa)		
D PRESL/HI	(KPa)		
D PRESH/LO	(KPa)		
D PRESH/HI	(KPa)		
D PRES2/LO	(KPa)		
D PRES2/HI	(KPa)		
D PRES3/LO	(KPa)		
D PRES3/HI	(KPa)		
DENSITY LO	(Kg/M3)		
DENSITY HI	(KG/M3)		

9.5.3 DISCRETES

LV DENSITY
LV ENERGY
CHROM
VP 1
VP 2
OPEN 2
CLOSE 2
OPEN 3
CLOSE 3
INPUT 3
INPUT 4
INPUT 9
INPUT 10
INPUT 16
INPUT 17
OUTPUT 13
OUTPUT 14
OUTPUT 15

9.5.4 CONFIG

ORIF DIAM1	(MM)	ATMS PRES	(KPa)
PIPE DIAM1	(MM)	PRES BASE	(KPa)
ZFLOW LIM1	(KPa)	TEMP BASE	(DEG C)
TAP LCTN 1		AGA8 MTHD	
TAP TYPE 1		SG SELECT	
ORIF DIAM2	(MM)	ORIF MTRL	
PIPE DIAM2	(MM)	PIPE MTRL	
ZFLOW LIM2	(KPa)	TREF ORIF	(DEG C)
TAP LCTN 2		TREF PIPE	(DEG C)
TAP TYPE 2		CHROM ADDR	
ORIF DIAM3	(MM)	CHROM STRM	
PIPE DIAM3	(MM)	VERSION	
ZFLOW LIM3	(KPa)		
TAP LCTN 3			
TAP TYPE 3			

9.5.5 GAS DATA

SPEC GRAV	
HEAT VALUE	(MJ/M3)
CO2	(MOL%)
N2	(MOL%)
VISCOSITY	(cP)
SPEC HEAT	
METHANE	(MOL%)
ETHANE	(MOL%)
PROPANE	(MOL%)
H20	(MOL%)
H2S	(MOL%)
HYDROGEN	(MOL%)
CO	(MOL%)
OXYGEN	(MOL%)
I-BUTANE	(MOL%)
BUTANE	(MOL%)
I-PENTANE	(MOL%)
PENTANE	(MOL%)
HEXANE	(MOL%)
HEPTANE	(MOL%)
OCTANE	(MOL%)
NONANE	(MOL%)
DECANE	(MOL%)
HELIUM	(MOL%)
ARGON	(MOL%)

9.5.6 CONTROL

VPP 1	(M^3)
PP 1	(SEC)
VPP 2	(M^3)
PP 2	(SEC)
TS ENABLE	
OPEN 2 SP	(KPa)
CLOSE 2 SP	(KPa)
OPEN 3 SP	(KPa)
CLOSE 3 SP	(KPa)
TS DELAY	(SECS)
TS VLV TIM	(SECS)
VP MODE	
FLW SETPNT	(M3/HR)
DEADBAND	(%)
SMALL STEP	(%)
LARGE STEP	(%)
FINE CNTRL	(%)
PRES CHAN#	
OVRD PRESS	(KPa)
DP LIMIT	(KPa)
PRESET POS	(%)
UPDATE TIM	(SECS)
VALVE POS	(%)

9.5.7 CALC DATA

AGA8 MTHD
ZS
DENSITY-B (Kg/M3)
FLOW RATE1 (M3/HR)
FLOW RATE1 (TON/H)
EV 1
CD 1
Y FCTR 1
FLW EXTN 1
DENSITY-F1 (Kg/M3)
FLOW RATE2 (M3/HR)
FLOW RATE2 (TON/H)
EV 2
CD 2
Y FCTR 2
FLW EXTN 2
DENSITY-F2 (Kg/M3)
FLOW RATE 3 (M3/HR)
FLOW RATE 3 (TON/H)
EV 3
CD 3
Y FCTR 3
FLW EXTN 3
DENSITY-F3 (Kg/M3)
B - AGA8
C - AGA8
D - AGA8
K - AGA8
MOL WT.

9.5.8 RATE/VOLS

FLOW RATE1	(M3/HR)	FLOW RATE1	(TON/H)
FLOW RATE1	(M3/DY)	TODAY VOL1	(TONS)
TODAY VOL1	(M^3)	YSDAY VOL1	(TONS)
YSDAY VOL1	(M^3)	TOT VOL 1	(TONS)
TOT VOL 1	(M^3)	FLOW RATE2	(TON/H)
FLOW RATE2	(M3/HR)	TODAY VOL2	(TONS)
FLOW RATE2	(M3/DY)	YSDAY VOL2	(TONS)
TODAY VOL2	(M^3)	TOT VOL 2	(TONS)
YSDAY VOL2	(M^3)	FLOW RATE3	(TON/H)
TOT VOL 2	(M^3)	TODAY VOL3	(TONS)
FLOW RATE3	(M3/HR)	YSDAY VOL3	(TONS)
FLOW RATE3	(M3/DY)	TOT VOL 3	(TONS)
TODAY VOL3	(M^3)	STN FLW RT	(TON/H)
YSDAY VOL3	(M^3)	ST TDY VOL	(TONS)
TOT VOL 3	(M^3)	ST YSY VOL	(TONS)
STN FLW RT	(M3/HR)	ST TOT VOL	(TONS)
STN FLW RT	(M3/DY)		
ST TDY VOL	(M^3)		
ST YSY VOL	(M^3)		
ST TOT VOL	(M^3)		
ERATE 1	(GJ/HR)		
TDY ENRGY1	(GJ)		
YSY ENRGY1	(GJ)		
TOT ENRGY1	(GJ)		
ERATE 2	(GJ/HR)		
TDY ENRGY2	(GJ)		
YSY ENRGY2	(GJ)		
TOT ENRGY2	(GJ)		
ERATE 3	(GJ/HR)		
TDY ENRGY3	(GJ)		
YSY ENRGY3	(GJ)		
TOT ENRGY3	(GJ)		
STN ERATE	(GJ/HR)		
TDY ENERGY	(GJ)		
YSY ENERGY	(GJ)		
TOT ENERGY	(GJ)		

9.6 CALIBRATE UNIT MENU

The CALIBRATE UNIT menu provides for calibrating the SolarFlow Plus input circuitry to match the outputs of the transmitters for analog inputs to the SolarFlow Plus unit. The CALIBRATE UNIT menu has three selections: PRESSURES, TEMP and OTHERS. Refer to section 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

9.6.1 PRESSURES

The PRESSURES selection of the CALIBRATE UNIT menu provides for calibrating the pressure inputs listed as follows:

METR PRES
DIFF PRESL
DIFF PRESH
DIFF PRES2
DIFF PRES3

9.6.2 TEMPERATURE

The TEMP selection of the CALIBRATE UNIT menu provides for calibrating the METR TEMP selection.

9.6.3 OTHERS

The analog inputs listed as follows are calibrated in the OTHERS submenu of the CALIBRATE UNIT MENU:

LV DENSITY

9.7 MONITOR MENU

The MONITOR menu provides for witness testing analog inputs to the SolarFlow Plus unit. When the MONITOR menu is entered, all analog inputs are fixed at the values being transmitted to SolarFlow Plus when MONITOR is executed. The values remain fixed until the MONITOR menu is exited. The following analog inputs listed are available in the MONITOR menu in the triple orifice application. Refer to section 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES
METR TEMP
DIFF PRESL
DIFF PRESH
DIFF PRES2
DIFF PRES3
LV DENSITY

9.8 USER REPORT (CHANNEL 0)

Channel zero (0) is a predefined report list containing a report header and the channel data shown in the following table. The SolarFlow Plus unit displays the Users Report on the front panel in a scrolling format. Refer to section 9.3, "USER REP".

CHANNEL NUMBER	CHANNEL LABEL	DESCRIPTION
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in KPa
021	FLOW TEMP1	Live temperature in degrees Celsius (ºC)
032	COMP DPRES	Composite DP, Run No.1, value in kilopascals
024	D PRES2	Live DP, Run No.2, value in kilopascals
025	DIFF PRES3	Live DP, Run No.3, value in kilopascals
026	AUX ANLG 8 (LV DENSITY)	Live value for density
134	FLOW RATE1	Flow rate for meter No.1
139	TOT VOL 1	Total volume for meter No.1
164	FLOW RATE2	Flow rate for meter No.2
169	TOT VOL 2	Total volume for meter No.2
194	FLW RATE3	Flow rate for meter No.3
199	TOT VOL 3	Total volume for meter No.3
213	ST TDY VOL	Station today’s volume
214	YSDAY VOL	Station yesterday’s volume

9.9 DATA LOG LIST CONTENTS

The following are default items included on the data log. Refer to section 9.4.1, "LOG DEFINE". The data log is set to a 1-hour log interval. The default contract hour is 7:00 AM.

CHANNEL NUMBER	CHANNEL LABEL	DECIMAL PLACES	DIGITS	LOGGING TYPE
032	COMP DPRES	2	6	AVERAGE
020	METR PRES	1	6	AVERAGE
021	FLW TEMP	1	4	AVERAGE
133	FLW TIME 1	1	6	SNAPSHOT & ZERO
132	FLW EXTN 1	3	6	AVERAGE
136	LOG VOL1	0	8	SNAPSHOT & ZERO
024	DIFF PRES2	2	6	AVERAGE
163	FLW TIME 2	1	6	SNAPSHOT & ZERO
162	FLW EXTN 2	3	6	AVERAGE
166	LOG VOL2	0	8	SNAPSHOT & ZERO
025	DIFF PRES3	2	6	AVERAGE
193	FLW TIME 3	1	6	SNAPSHOT & ZERO
192	FLW EXTN 3	3	6	AVERAGE
196	LOG VOL3	0	8	SNAPSHOT & ZERO

9.10 DATA LOG HEADER BLOCK CONTENTS

The data log header block includes the following items for use on data log:

M PRES/LO
M PRES/HI
M TEMP/LO
M TEMP/HI
D PRESL/LO
D PRESL/HI
D PRESH/LO
D PRESH/HI
D PRES2/LO
D PRES2/HI

(Continued on the next page)

Data Log Header Block (Continued)

D PRES3/LO
D PRES3/HI
ORIF DIAM1
PIPE DIAM1
ZFLOW LIM1
TAP LCTN 1
TAP TYPE 1
ORIF DIAM2
PIPE DIAM2
ZFLOW LIM2
TAP LCTN 2
TAP TYPE 2
ORIF DIAM3
PIPE DIAM3
ZFLOW LIM3
TAP LCTN 3
TAP TYPE 3
ATMS PRES
PRES BASE
TEMP BASE
AGA8 MTHD
SG SELECT
ORIF MTRL
PIPE MTRL
TREF ORIF
TREF PIPE
SPEC GRAV
HEAT VALUE
CO2
N2
VISCOSITY
SPEC HEAT
METHANE
ETHANE
PROPANE
H2O
H2S
HYDROGEN
CO
OXYGEN
I-BUTANE
BUTANE
I-PENTANE
PENTANE
HEXANE
HEPTANE
OCTANE
NONANE
DECANE
HELIUM
ARGON

9.11 ALARM DEFINITIONS

The following is a listing of the Alarm definitions for this application. Note that the alarms will show up in the event log.

Number of Retries: 5 for alarms 1 through 9, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	C(19) < X	LOW BATTER	16.0	10.8	0.0	0
2	C(20) < X*S(20,F) or C(20) > Y*S(20,F)	METR PRES	6900	0.0	1.01	0
3	C(21) < X*S(21,F) or C(21) > Y*S(21,F)	FLOW TEMP	66.0	0.0	1.01	0
4*	C(22) < X*S(22,F) or C(22) > Y*S(22,F)	DIFF PRES1	7.5	0.0	1.01	0
5	C(23) < X*S(23,F) or C(23) > Y*S(23,F)	DIFF PRES1	37.5	0.0	1.01	0
6	C(24) < X*S(24,F) or C(24) > Y*S(24,F)	DIFF PRES2	37.5	0.0	1.01	0
7	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	DIFF PRES3	37.5	0.0	1.01	0
8*	C(26) < X*S(26,F) or C(26) > Y*S(26,F)	LIVE SG	50.0	0.0	1.01	0
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	99999999	0
10	C(30) <> 0.0	SYS ERROR	-	0.0	0	0

* These alarms should be disabled.

EXAMPLE:

Alarm # 2

Y	=	1.01
S(20,F)	=	The full-scale value for channel 20, which is the static pressure transmitter. SolarFlow Plus automatically generates this value based on the full-scale value entered while in the SETUP UNIT submenu.
F	=	6900 KPa

Therefore, the alarm setpoint for alarm #2 is 1.01(6900) = 6969 KPa.

When the ALARM menu is entered using the HHDT the user may modify the X, Y, or Z values shown in the above alarm conditions by changing the values for LOW, HIGH, and ALT. This enables the user to adjust the alarm limit(s) to match the requirements.

The value for X is represented by LOW on the HHDT ALARM SETUP menu. The value for Y is represented by HIGH on the HHDT ALARM SETUP menu. The value for Z is represented by ALT on the HHDT ALARM SETUP menu.

The ALARM menu is also used to acknowledge alarms and to activate or deactivate alarms.

To acknowledge an alarm condition displayed on the LCD of SolarFlow Plus, enter the ALARM menu of the HHDT and select the ACKNOWLEDGE sub-menu. Any existing unacknowledged alarms are displayed and the HHDT prompts: "ACKNOWLEDGE ? Y/N". Press the ENTER key to acknowledge the alarm. Once this has been done and the user has logged off SolarFlow Plus the activated alarm is displayed with the message "ACKNOWLEDGED" following the alarm condition. If the alarm condition no longer exists and has not been acknowledged it remains on the LCD until acknowledged.

To activate or deactivate alarms, enter the HHDT ALARM menu and select the SETUP sub-menu. The HHDT displays the various alarms that are available in the program. Scroll to the desired alarm and press the ENTER key at the desired alarm condition. The HHDT provides four options; STAT, LOW, HIGH, and ALT. Press ENTER at the STAT option. The HHDT shows either ON or OFF and prompts OK?. To turn off the alarm, press the NO key until OFF is displayed, then press ENTER.

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ISO-5167V DUAL ORIFICE SEPARATE TEMPERATURE APPLICATION

10.0 DUAL ORIFICE SEPARATE TEMPERATURE APPLICATION

Section 10 covers the individual requirements for the ISO-5167V dual orifice separate temperature application (DUAL 5167V SEPT) configured to calculate mass and volumetric flow rate using equations from ISO-5167:1991. The dual orifice separate temperature application supports measurement on two meter tubes with separate temperatures and pressures. Optional capabilities such as valve positioning, chromatograph inputs, etc. are listed as part of the setup. If you do not need some of these capabilities, they may be skipped when entering the setup parameters with the Handheld Data Terminal (HHDT). Channels 1 and 2 are digital inputs which indicate whether an analog input is used for live density and energy respectively. To select fixed values, these inputs should be jumpered to ground; for live values, the inputs should be left open. Analog inputs use Channels 19 through 26. Any unused analog input should be jumpered to ground.

When the SolarFlow Plus is configured for a new application, all channels are set to default values, and the Alarm definitions, Log definition, User Report list, and Analog Input channels are set to the values corresponding to the configuration chosen. The event log remains intact, but the data log is emptied.

10.1 FIELD WIRING CONNECTIONS

Before exchanging your EPROM set for working installations, make sure that all previous data is recorded as needed. Make sure that your slide switch settings are set in accordance with the information in section 1.13. No changes should be required unless the previously used application has been significantly different. Configurations for this application include the static pressure and DP transmitter(s) associated with meter 1 installed within the Model 2470 enclosure with all other transmitters installed externally, or with *all* transmitters installed externally.

The wiring configuration for the dual orifice separate temperature analog inputs are shown in this section.

A field wiring diagram is provided in the Model 2470 System Reference Manual. The following information furnishes necessary details for wiring both internal and external transmitters.

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
20	INTERNAL, static pressure (factory installed)	White (Blue*) Green (Black*) Black (Red*)	23 26 25	Signal in + Analog ground 8 to 10 VDC
*	SolarFlow Plus units fitted with Statham 35PG series static pressure transmitters are wired with the blue, black, and red wires.			
		or		
20	EXTERNAL, static pressure (to be installed by user)	Blue Black Red Shield	23 26 25 24	Signal in + Analog ground 8 to 10 VDC Earth ground
21	EXTERNAL, static pressure Meter Tube No.2 (to be installed by user)	Blue Black Red Shield	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	EXTERNAL, temperature (to be installed by user)	Blue Black Red Shield	31 34 33 32	Signal in + Analog ground 8 to 10 VDC Earth ground
23	INTERNAL, differential pressure (DP) No.1 (factory installed)	Violet Black Gray	35 38 37	Signal in + Analog ground 8 to 10 VDC
		or		
23	EXTERNAL, differential (DP) No.1 (to be installed by user)	Blue Black Red Shield	35 38 37 36	Signal in + Analog ground 8 to 10 VDC Earth ground
24	EXTERNAL, DP No.2 (to be installed by user)	Blue Black Red Shield	39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
25	EXTERNAL, LV DENSITY (1) (2) (to be installed by user)		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	EXTERNAL, Meter temperature No.2 (to be installed by user)		47 50 49 48	Signal in + Analog ground 8 to 10 VDC Earth ground

NOTES:

(1) Since fixed values are normally desired for density and energy, digital input channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 59 and 60, 52 and 61 on the rear termination board. The fixed values for heat value and the specific gravity are entered in the GAS DATA submenu of the SETUP UNIT menu by keying in the desired value. Refer to the System Wiring Diagram.

(2) Wire for connecting the external transmitter inputs is user-supplied.

(3) If only one meter run is used with this application, jumper the unused inputs to analog ground e.g., if channels 24 or 25 are not used, jumper pin No. 39 to 42 and/or pin No. 43 to 46.

10.2 STATUS SIGNAL CONNECTIONS

This application supports status inputs that are activated by a dry contact closure between the status input pin number and common.

10.2.1 INPUTS

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
1	Live or fixed density	LV DENSITY	60 59 (GND)	Open, means use live density Shorted, means calculate density
2	Live or fixed energy	LV ENERGY	61 52 (GND)	Open, means use live energy Shorted, means use fixed energy
18	Chromatograph option	CHROM	68 58 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

	CH 1	CH 2	CH 18
Live SG and HV	No jumper	No jumper	No jumper
Fixed SG and HV	Jumper/GND	Jumper/GND	No jumper
Serial Chromatograph	Jumper/GND	Jumper/GND	Jumper/GND

Note that serial chromatograph inputs require that SG and HV be jumpered to ground as if fixed.

10.2.2 OUTPUTS

NOTE: All output signals from a SolarFlow Plus unit installed in a hazardous location must be isolated by means of intrinsic safety barriers.

This application has two form-A relays (mounted on the SolarFlow Plus PC board) that provide digital outputs for corrected station volume on Channels 5 and 6. The volume per pulse and the pulse period of the relays may be changed using the HHDT. Prompts for changing the relay volume per pulse (VPP1 and VPP2) and pulse period (PP1 and PP2) are included in the discussion of the CONTROL submenu of the SETUP UNIT menu, section 10.4.7.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	15 16	Form-A relay Common
6	Volume pulse output 2	VP2	17 18	Form-A relay Common

TTL level outputs for the following channels are available at the termination board pin numbers shown in the following table.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	78 76	TTL Output Common
6	Volume pulse output 2	VP2	79 77	TTL Output Common
7	Valve control open	OPEN 2	80 75	TTL Output Common
8	Valve control close	CLOSE 2	81 74	TTL Output Common

10.2.3 ANALOG OUTPUT CONNECTIONS

This application provides two 1-5 VDC analog outputs.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
27	Flow rate output	FLW RT OUT	3 4	Analog output 1 Ground
28	Valve positioning	VALVE POS	1 2	Analog output 2 Ground

10.2.4 CHROMATOGRAPH INTER-CONNECTIONS

For more detail in wiring the Model 2252 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 systems Reference Manual.

MODEL 2252	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out Serial in Ground	102 103 106	DI in DI out DI ground

10.3 SETUP LOCATION MENU

The SolarFlow Plus operating parameters for the ISO-5167V dual orifice separate temperature application that can be changed in the SETUP LOCATION menu are shown in the following table described by the HHDT prompt for the parameter, the factory-installed default value, and a blank space for entering the desired value if different from the factory default. Additional information on the SETUP LOCATION menu is provided in section 5.10.1 of the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT	DESIRED
LOC NAME	BLANK LOCATION	_____
LOC ID	0	_____
DATE	010180 MMDDYY	_____
WEEK DAY	1 (1-7)	_____
TIME	0000 HHMM	_____
SEC CODE(1)	120	_____
USER REP(2)	****	_____
PCOMM RATE(3)	300 BPS	_____
RTS DELAY(4)	0 1/100s	_____

NOTES:

(1) Refer to section 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.

(2) Refer to section 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt. Refer to section 10.8, this manual, for default listing.

(3) Refer to section 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.

(4) Refer to section 5.10.1.9 in the Model 2470 System Reference Manual for a complete discussion of the RTS DELAY prompt.

10.4 SETUP UNIT MENU

The parameters for the ISO-5167V dual orifice separate temperature application of SolarFlow Plus that can be changed in the submenus of the SETUP UNIT menu using the HHDT are tabulated as follows. The SETUP MENU has eight submenus: GENERAL, ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, AND CALC DATA. The parameters are tabulated by the HHDT prompt for the parameter, the factory-installed default, and a blank space for entering the desired value if different from the factory default.

10.4.1 GENERAL SUBMENU

The following parameters can be changed in the GENERAL submenu of the SETUP UNIT menu of the HHDT.

HHDT PROMPT	DEFAULT	DESIRED
UNIT NAME	BLANK UNIT	_____
UNIT ID	BLANK-ID	_____
CONTRCT HR	7 (0-23)	_____
LOG INTRVL	1 HOUR	_____
LOG DEFINE(1)		_____
RESET CMOD(2)	OFF	_____

NOTES:

(1) All data logs in the SolarFlow Plus memory are automatically erased and can no longer be recovered any time a change is made in the LOG DEFINE menu. Refer to section 1.9 for a description of the LOG DEFINE prompt. Refer to section 10.9 for default listing.

(2) The RESET CMOD (Reset Calculations Module) prompt selects the calculation module for an alternate SolarFlow Plus application. RESET CMOD is discussed in detail in section 5.10.2.1.6 in the Model 2470 SolarFlow Plus System Reference Manual.

10.4.2 ANALOGS SUBMENU

The ANALOGS submenu of the SETUP UNIT menu provides for toggling between LIVE and FIXED values of the following analog inputs. The AUX1 key on the HHDT toggles the input between the fixed and live values. A fixed value is shown by an asterisk (*) following the analog value in the display. For additional information, refer to the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT
METR PRES1	xxxxx KPa
METR PRES2	xxxxx KPa
METR TEMP1	xxxxx DEG C
METR TEMP2	xxxxx DEG C
DIFF PRES1	xxxxx KPa
DIFF PRES2	xxxxx KPa
LV DENSITY	xxxxx Kg/M3
BATTERY	xxxxx VOLTS
FLW RT OUT	xxxxx M3/HR
VALVE POS	xxxxx %

10.4.3 SCALES SUBMENU

The high- and low-scale values for the analogs shown in the following table can be modified in the SCALES submenu of the SETUP UNIT menu. Refer to section 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

HHDT PROMPT	DEFAULT		DESIRED
M PRES1/LO	0.0	KPa	_____
M PRES1/HI	6900.0	KPa	_____
M PRES2/LO	0.0	KPa	_____
M PRES2/HI	6900.0	KPa	_____
M TEMP1/LO	-18.0	DEG C	_____
M TEMP1/HI	66.0	DEG C	_____
M TEMP2/LO	-18.0	DEG C	_____
M TEMP2/HI	66.0	DEG C	_____
D PRES1/LO	0.0	KPa	_____
D PRES1/HI	37.50	KPa	_____
D PRES2/LO	0.0	KPa	_____
D PRES2/HI	37.50	KPa	_____
DENSITY LO	0.0	Kg/M3	_____
DENSITY HI	100.0	Kg/M3	_____
FLW RT LOW	0	M3/HR	_____
FLW RT HI	50000	M3/HR	_____
VLV POS LO	0.0	%	_____
VLV POS HI	100.0	%	_____

10.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
OPEN 2	ON
CLOSE 2	OFF
OPEN 3 *	ON
CLOSE 3 *	OFF
OUTPUT 13	OFF
OUTPUT 14	OFF
OUTPUT 15	OFF

* Not used for this application.

10.4.5 CONFIG SUBMENU

The following default parameters can be changed in the CONFIG submenu of the SETUP UNIT menu. Refer to section 5.10.2.4 in the Model 2470 System Reference Manual for additional information about the CONFIG submenu.

HHDT PROMPT	SAMPLE VALUES		DESIRED
ORIF DIAM1	100.0	MM	_____
PIPE DIAM1	200.0	MM	_____
ZFLOW LIM1	0.10	KPa	_____
TAP LCTN 1	0		_____
TAP TYPE 1	0		_____
ORIF DIAM2	100.0	MM	_____
PIPE DIAM2	200.0	MM	_____
ZFLOW LIM2	0.10	KPa	_____
TAP LCTN 2	0		_____
TAP TYPE 2	0		_____
ATMS PRES	101.325	KPa	_____
PRES BASE	101.325	KPa	_____
TEMP BASE	15.0	DEG C	_____
AGA8 MTHD	0		_____
SG SELECT	1		_____
ORIF MTRL	1		_____
PIPE MTRL	0		_____
TREF ORIF	20.0	DEG C	_____
TREF PIPE	20.0	DEG C	_____
CHROM ADDR	1		_____
CHROM STRM	1		_____
VERSION	2.4		_____

10.4.6 GAS DATA

This ISO-5167V SolarFlow Plus software can accept information from the Model 2252 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 59 on the termination board. In addition, the MODBUS communication address and the chromatograph stream number desired must be programmed in by the HHDT (CONFIG SUBMENU). The Solarflow Plus will then poll the chromatograph once every four minutes automatically. Refer to section 1.5.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
SPEC GRAV	0.6000		_____
HEAT VALUE	36.251	MJ/M3	_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
VISCOSITY	0.010268	cP	_____
SPEC HEAT	1.30		_____
METHANE	95.000	MOL%	_____
ETHANE	5.000	MOL%	_____
PROPANE	0.000	MOL%	_____
H2O	0.000	MOL%	_____
H2S	0.000	MOL%	_____
HYDROGEN	0.000	MOL%	_____
CO	0.000	MOL%	_____
OXYGEN	0.000	MOL%	_____
I-BUTANE	0.000	MOL%	_____
BUTANE	0.000	MOL%	_____
I-PENTANE	0.000	MOL%	_____
PENTANE	0.000	MOL%	_____
HEXANE	0.000	MOL%	_____
HEPTANE	0.000	MOL%	_____
OCTANE	0.000	MOL%	_____
NONANE	0.000	MOL%	_____
DECANE	0.000	MOL%	_____
HELIUM	0.000	MOL%	_____
ARGON	0.000	MOL%	_____

10.4.7 CONTROL SUBMENU

The CONTROL submenu of the SETUP UNIT menu provides for entering the control values primarily for the valve positioning and tube switching. Refer to sections 1.6 and 1.7 for more information.

HHDT PROMPT	DEFAULT		DESIRED
VPP 1	1000	M^3	_____
PP 1	1	SEC	_____
VPP 2	1000	M^3	_____
PP 2	1	SEC	_____
TS ENABLE	0		_____
OPEN 2 SP	25.00	KPa	_____
CLOSE 2 SP	5.00	KPa	_____
TS DELAY	30	SECS	_____
TS VLV TIM	30	SECS	_____
VP MODE	0		_____
FLW SETPNT	0	M3/HR	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5	%	_____
PRES CHAN#	20		_____
OVRD PRESS	0	KPa	_____
DP LIMIT	0	KPa	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALVE POS	50.0	%	_____

10.4.8 CALCULATED DATA

The CALC DATA submenu of the SETUP UNIT menu allows the user to determine the calculated values for specified application inputs. The values shown here are typical values and not default values.

HHDT PROMPT	SAMPLE VALUES	
AGA8 MTHD	0	
ZS	0.997811	
DENSITY-B	0.8050	Kg/M3
FLOW RATE1	0	M3/HR
FLOW RATE1	0.00	TON/H
EV 1	1.03164	
CD 1	0.603166	
Y FCTR 1	0.999892	
FLW EXTN 1	94.841	
DENSITY-F1	5.327	Kg/M3
FLOW RATE2	0	M3/HR
FLOW RATE2	0.00	TON/H
EV 2	1.0000	
CD 2	0.600000	
Y FCTR 2	1.000000	
FLW EXTN 2	0.000	
DENSITY-F2	1.000000	Kg/M3
B - AGA8	0.033417	
C - AGA8	0.002236	
D - AGA8	0.266296	
K - AGA8	0.100912	
MOL WT.	16.7444	

10.5 DISPLAY MENU

The DISPLAY Menu of the HHDT provides for viewing the various setup parameters and calculated values in a SolarFlow Plus unit at any given time. The menu is for display purposes only. No changes can be made to the values displayed using this menu. The Display menu has eight selections: ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, CALC DATA and RATE/VOLS.

10.5.1 ANALOGS

METR PRES1	(KPa)
METR PRES2	(KPa)
METR TEMP1	(DEG C)
METR TEMP2	(DEG C)
DIFF PRES1	(KPa)
DIFF PRES2	(KPa)
LV DENSITY	(Kg/M3)
BATTERY	(VOLTS)
FLW RT OUT	(M3/HR)
VALVE POS	(%)

10.5.2 SCALES

M PRES1/LO	(KPa)	FLW RT LOW	(M3/HR)
M PRES1/HI	(KPa)	FLW RT HI	(M3/HR)
M PRES2/LO	(KPa)	VLV POS LO	(%)
M PRES2/HI	(KPa)	VLV POS HI	(%)
M TEMP1/LO	(DEG C)		
M TEMP1/HI	(DEG C)		
M TEMP2/LO	(DEG C)		
M TEMP2/HI	(DEG C)		
D PRES1/LO	(KPa)		
D PRES1/HI	(KPa)		
D PRES2/LO	(KPa)		
D PRES2/HI	(KPa)		
DENSITY LO	(Kg/M3)		
DENSITY HI	(Kg/M3)		

10.5.3 DISCRETES

LV DENSITY	OPEN 3
LV ENERGY	CLOSE 3
CHROM	OUTPUT 13
VP 1	OUTPUT 14
VP 2	OUTPUT 15
OPEN 2	
CLOSE 2	
INPUT 3	
INPUT 4	
INPUT 9	
INPUT 10	
INPUT 16	
INPUT 17	

10.5.4 CONFIG

ORIF DIAM1	(MM)	SG SELECT	
PIPE DIAM1	(MM)	ORIF MTRL	
ZFLOW LIM1	(KPa)	PIPE MTRL	
TAP LCTN 1		TREF ORIF	(DEG C)
TAP TYPE 1		TREF PIPE	(DEG C)
ORIF DIAM2	(MM)	CHROM ADDR	
PIPE DIAM2	(MM)	CHROM STRM	
ZFLOW LIM2	(KPa)	VERSION	
TAP LCTN 2			
TAP TYPE 2			
ATMS PRES	(KPa)		
PRES BASE	(KPa)		
TEMP BASE	(DEG C)		
AGA8 MTHD			

10.5.5 GAS DATA

SPEC GRAV	
HEAT VALUE	(MJ/M3)
CO2	(MOL%)
N2	(MOL%)
VISCOSITY	(cP)
SPEC HEAT	
METHANE	(MOL%)
ETHANE	(MOL%)
PROPANE	(MOL%)
H20	(MOL%)
H2S	(MOL%)
HYDROGEN	(MOL%)
CO	(MOL%)
OXYGEN	(MOL%)
I-BUTANE	(MOL%)
BUTANE	(MOL%)
I-PENTANE	(MOL%)
PENTANE	(MOL%)
HEXANE	(MOL%)
HEPTANE	(MOL%)
OCTANE	(MOL%)
NONANE	(MOL%)
DECANE	(MOL%)
HELIUM	(MOL%)
ARGON	(MOL%)

10.5.6 CONTROL

VPP 1	(M^3)
PP 1	(SEC)
VPP 2	(M^3)
PP 2	(SEC)
TS ENABLE	
OPEN 2 SP	(KPa)
CLOSE 2 SP	(KPa)
TS DELAY	(SECS)
TS VLV TIM	(SECS)
VP MODE	
FLW SETPNT	(M3/HR)
DEADBAND	(%)
SMALL STEP	(%)
LARGE STEP	(%)
FINE CNTRL	(%)
PRES CHAN#	
OVRD PRESS	(KPa)
DP LIMIT	(KPa)
PRESET POS	(%)
UPDATE TIM	(SECS)
VALVE POS	(%)

10.5.7 CALC DATA

AGA8 MTHD
ZS
DENSITY-B (Kg/M3)
FLOW RATE1 (M3/HR)
FLOW RATE1 (TON/H)
EV 1
CD 1
Y FCTR 1
FLW EXTN 1
DENSITY-F1 (Kg/M3)
FLOW RATE2 (M3/HR)
FLOW RATE2 (TON/H)
EV 2
CD 2
Y FCTR 2
FLW EXTN 2
DENSITY-F2 (Kg/M3)
B - AGA8
C - AGA8
D - AGA8
K - AGA8
MOL WT.

10.5.8 RATE/VOLS

FLOW RATE1	(M3/HR)
FLOW RATE1	(M3/DY)
TODAY VOL1	(M^3)
YSDAY VOL1	(M^3)
TOT VOL 1	(M^3)
FLOW RATE2	(M3/HR)
FLOW RATE2	(M3/DY)
TODAY VOL2	(M^3)
YSDAY VOL2	(M^3)
TOT VOL 2	(M^3)
STN FLW RT	(M3/HR)
STN FLW RT	(M3/DY)
ST TDY VOL	(M^3)
ST YSY VOL	(M^3)
ST TOT VOL	(M^3)
ERATE 1	(GJ/HR)
TDY ENRGY1	(GJ)
YSY ENRGY1	(GJ)
TOT ENRGY1	(GJ)
ERATE 2	(GJ/HR)
TDY ENRGY2	(GJ)
YSY ENRGY2	(GJ)
TOT ENRGY2	(GJ)
STN ERATE	(GJ/HR)
TDY ENERGY	(GJ)
YSY ENERGY	(GJ)
TOT ENERGY	(GJ)
FLOW RATE1	(TON/H)
TODAY VOL1	(TONS)
YSDAY VOL1	(TONS)
TOT VOL 1	(TONS)
FLOW RATE2	(TON/H)
TODAY VOL2	(TONS)
YSDAY VOL2	(TONS)
TOT VOL 2	(TONS)
STN FLW RT	(TON/H)
ST TDY VOL	(TONS)
ST YSY VOL	(TONS)
ST TOT VOL	(TONS)

10.6 CALIBRATE UNIT MENU

The CALIBRATE UNIT menu provides for calibrating the SolarFlow Plus input circuitry to match the outputs of the transmitters for analog inputs to the SolarFlow Plus unit. The CALIBRATE UNIT menu has three selections: PRESSURES, TEMP and OTHERS. Refer to section 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

10.6.1 PRESSURES

The PRESSURES selection of the CALIBRATE UNIT menu provides for calibrating the pressure inputs listed as follows:

METR PRES1
METR PRES2
DIFF PRES1
DIFF PRES2.

10.6.2 TEMPERATURE

The TEMP selection of the CALIBRATE UNIT menu provides for calibrating the METR TEMP selections.

METR TEMP1
METR TEMP2

10.6.3 OTHERS

The analog inputs listed as follows are calibrated in the OTHERS submenu of the CALIBRATE UNIT MENU:

LV DENSITY.

10.7 MONITOR MENU

The MONITOR menu provides for witness testing analog inputs to the SolarFlow Plus unit. When the MONITOR menu is entered, all analog inputs are fixed at the values being transmitted to SolarFlow Plus when MONITOR is executed. The values remain fixed until the MONITOR menu is exited. The following analog inputs listed are available in the MONITOR menu in the dual orifice common application. Refer to section 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES1
METR PRES2
DIFF PRES1
DIFF PRES2
METR TEMP1
METR TEMP2
LV DENSITY

10.8 USER REPORT (CHANNEL 0)

Channel zero (0) is a predefined report list containing a report header and the channel data shown in the following table. The SolarFlow Plus unit displays the Users Report on the front panel in a scrolling format. Refer to section 10.3, "USER REP".

CHANNEL NUMBER	CHANNEL LABEL	DESCRIPTION
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in KPa
023	DIFF PRES1	Live DP, Run No.1, value in kilopascals
022	FLOW TEMP1	Live temperature in degrees Celsius (°C)
021	METR PRES2	Live pressure meter No.2 in KPa
024	DIFF PRES2	Live DP, Run No.2, value in kilopascals
026	FLOW TEMP2	Live temperature in degrees Celsius (°C)
025	AUX ANLG 7 (LV DENSITY)	Live value for density
134	FLOW RATE1	Flow rate for meter No.1
139	TOT VOL 1	Total volume for meter No.1
164	FLOW RATE2	Flow rate for meter No.2
169	TOT VOL 2	Total volume for meter No.2
213	ST TDY VOL	Station today's volume
214	YSDAY VOL	Station yesterday's volume

10.9 DATA LOG LIST CONTENTS

The following are default items included on the data log. Refer to section 10.4.1, "LOG DEFINE". The data log is set to a 1-hour log interval. The default contract hour is 7:00 AM.

CHANNEL NUMBER	CHANNEL LABEL	DECIMAL PLACES	DIGITS	LOGGING TYPE
023	DIFF PRES1	2	6	AVERAGE
020	METR PRES1	1	6	AVERAGE
022	FLW TEMP1	1	4	AVERAGE
133	FLW TIME 1	1	6	SNAPSHOT & ZERO
132	FLW EXTN 1	3	6	AVERAGE
136	LOG VOL1	0	8	SNAPSHOT & ZERO
146	LOG VOL1	2	6	SNAPSHOT & ZERO
024	DIFF PRES2	2	6	AVERAGE
021	METR PRES2	1	6	AVERAGE
026	FLW TEMP2	1	4	AVERAGE
163	FLW TIME 2	1	6	SNAPSHOT & ZERO
162	FLW EXTN 2	3	6	AVERAGE
166	LOG VOL2	0	8	SNAPSHOT & ZERO
176	LOG VOL2	2	6	SNAPSHOT & ZERO

10.10 DATA LOG HEADER BLOCK CONTENTS

The data log header block includes the following items for use on data log:

M PRES1/LO
M PRES1/HI
M PRES2/LO
M PRES2/HI
M TEMP1/LO
M TEMP1/HI
M TEMP2/LO
M TEMP2/HI
D PRES1/LO
D PRES1/HI
D PRES2/LO
D PRES2/HI
ORIF DIAM1
PIPE DIAM1
ZFLOW LIM1
TAP LCTN 1
TAP TYPE 1
ORIF DIAM2
PIPE DIAM2
ZFLOW LIM2
TAP LCTN 2
TAP TYPE 2
ATMS PRES
PRES BASE
TEMP BASE
AGA8 MTHD
SG SELECT
ORIF MTRL
PIPE MTRL
TREF ORIF
TREF PIPE
SPEC GRAV
HEAT VALUE

(Continued on the next page)

CO2
N2
VISCOSITY
SPEC HEAT
METHANE
ETHANE
PROPANE
H2O
H2S
HYDROGEN
CO
OXYGEN
I-BUTANE
BUTANE
I-PENTANE
PENTANE
HEXANE
HEPTANE
NONANE
DECANE
HELIUM
ARGON

10.11 ALARM DEFINITIONS

The following is a listing of the Alarm definitions for this application. Note that the alarms will show up in the event log.
Number of Retries: 5 for alarms 1 through 9, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	C(19) < X	LOW BATTER	16.0	10.8	0.0	0
2	C(20) < X*S(20,F) or C(20) > Y*S(20,F)	METR PRES1	6900.0	0.0	1.01	0
3	C(21) < X*S(21,F) or C(21) > Y*S(21,F)	METR PRES2	6900.0	0.0	1.01	0
4	C(22) < X*S(22,F) or C(22) > Y*S(22,F)	FLOW TEMP1	66.0	0.0	1.01	0
5	C(23) < X*S(23,F) or C(23) > Y*S(23,F)	DIFF PRES1	37.5	0.0	1.01	0
6	C(24) < X*S(24,F) or C(24) > Y*S(24,F)	DIFF PRES2	37.5	0.0	1.01	0
7*	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	LIVE SG	100.0	0.0	1.01	0
8	C(26) < X*S(26,F) or C(26) > Y*S(26,F)	FLOW TEMP2	66.0	0.0	1.01	0
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	99999999	0
10	C(30) <> 0.0	SYS ERROR	-	0.0	0.0	0

* These alarms should be disabled.

EXAMPLE:

Alarm # 2

Y	=	1.01
S(20,F)	=	The full-scale value for channel 20, which is the static pressure transmitter. SolarFlow Plus automatically generates this value based on the full-scale value entered while in the SETUP UNIT submenu.
F	=	6900 KPa

Therefore, the alarm setpoint for alarm #2 is 1.01(6900) = 6969 KPa.

When the ALARM menu is entered using the HHDT the user may modify the X, Y, or Z values shown in the above alarm conditions by changing the values for LOW, HIGH, and ALT. This enables the user to adjust the alarm limit(s) to match the requirements.

The value for X is represented by LOW on the HHDT ALARM SETUP menu. The value for Y is represented by HIGH on the HHDT ALARM SETUP menu. The value for Z is represented by ALT on the HHDT ALARM SETUP menu.

The ALARM menu is also used to acknowledge alarms and to activate or deactivate alarms.

To acknowledge an alarm condition displayed on the LCD of SolarFlow Plus, enter the ALARM menu of the HHDT and select the ACKNOWLEDGE sub-menu. Any existing unacknowledged alarms are displayed and the HHDT prompts: "ACKNOWLEDGE ? Y/N". Press the ENTER key to acknowledge the alarm. Once this has been done and the user has logged off SolarFlow Plus the activated alarm is displayed with the message "ACKNOWLEDGED" following the alarm condition. If the alarm condition no longer exists and has not been acknowledged it remains on the LCD until acknowledged.

To activate or deactivate alarms, enter the HHDT ALARM menu and select the SETUP sub-menu. The HHDT displays the various alarms that are available in the program. Scroll to the desired alarm and press the ENTER key at the desired alarm condition. The HHDT provides four options; STAT, LOW, HIGH, and ALT. Press ENTER at the STAT option. The HHDT shows either ON or OFF and prompts OK?. To turn off the alarm, press the NO key until OFF is displayed, then press ENTER.

ISO - 5167V BIDIRECTIONAL DUAL ORIFICE APPLICATION

11.0 BIDIRECTIONAL DUAL ORIFICE APPLICATION

Section 11 covers the individual requirements for the bidirectional dual orifice application (BIDIR DUAL 5167V) configured to calculate mass and volumetric flow rate using equations from ISO-5167:1991. The bidirectional dual orifice application supports measurement on two meter tubes with a common temperature and meter (static) pressure. Note that the station rates and volumes represent meter run No. 1 minus meter run No. 2 instead of the sum. Optional capabilities such as valve positioning, chromatograph inputs, etc. are listed as part of the setup. If you do not need some of these capabilities, they may be skipped when entering the setup parameters with the Handheld Data Terminal (HHDT). Channels 1 and 2 are digital inputs which indicate whether an analog input is used for live density and energy respectively. To select fixed values, these inputs should be jumpered to ground; for live values, the inputs should be left open. Analog inputs use channels 19 through 26. Any non-used analog inputs should be jumpered to ground.

When the SolarFlow Plus is configured for a new application, all channels are set to default values, and the Alarm definitions, Log definition, User Report list, and Analog Input channels are set to the values corresponding to the configuration chosen. The event log remains intact, but the data log is emptied.

11.1 FIELD WIRING CONNECTIONS

Before exchanging your EPROM set for working installations, make sure that all previous data is recorded as needed. Make sure that your slide switch settings are set in accordance with the information in section 1.13. No changes should be required unless the previously used application has been significantly different. Configurations for this application include the static pressure and DP transmitter(s) associated with meter 1 installed within the Model 2470 enclosure with all other transmitters installed externally, or with *all* transmitters installed externally.

The wiring configuration for the bidirectional dual orifice analog inputs is shown in this section.

A field wiring diagram is provided in the Model 2470 System Reference Manual. The following information furnishes necessary details for wiring both internal and external transmitters.

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
20	INTERNAL, static pressure (factory installed)	White (Blue*) Green (Black*) Black (Red*)	23 26 25	Signal in + Analog ground 8 to 10 VDC
*	SolarFlow Plus units fitted with Statham 36PG series static pressure transmitters are wired with the blue, black, and red wires.			
		or		
20	EXTERNAL, static pressure (to be installed by user)	Blue Black Red Shield	23 26 25 24	Signal in + Analog ground 8 to 10 VDC Earth ground
21	EXTERNAL, LV DENSITY (1) (2) (to be installed by user)	Blue Black Red Shield	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	EXTERNAL, temperature (to be installed by user)	Blue Black Red Shield	31 34 33 32	Signal in + Analog ground 8 to 10 VDC Earth ground
23	INTERNAL, differential pressure (DP) No.1 (factory installed)	Violet Black Gray	35 38 37	Signal in + Analog ground 8 to 10 VDC
		or		
23	EXTERNAL, differential (DP) No.1 (to be installed by user)	Blue Black Red Shield	35 38 37 36	Signal in + Analog ground 8 to 10 VDC Earth ground
24	EXTERNAL, DP No.2 (to be installed by user)	Blue Black Red Shield	39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground

CH	TRANSMITTER TYPE	WIRE COLOR	PIN NO.	SIGNAL TYPE
25	EXTERNAL, AUX ANLG 7 (to be installed by user)		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	EXTERNAL, LV ENERGY (to be installed by user)		47 50 49 48	Signal in + Analog ground 8 to 10 VDC Earth ground

NOTES:

(1) Since fixed values are normally desired for density and energy, digital input channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 59 and 60, 52 and 61 on the rear termination board. The fixed values for heat value and specific gravity are entered in the GAS DATA submenu of the SETUP UNIT menu by keying in the desired value. Refer to the System Wiring Diagram.

(2) Wire for connecting the external transmitter inputs is user-supplied.

(3) If only one meter run is used with this application, jumper the unused differential pressure inputs to analog ground e.g., if channels 24 or 25 are not used, jumper pin No. 39 to 42 and/or pin No. 43 to 46.

11.2 STATUS SIGNAL CONNECTIONS

This application supports status inputs that are activated by a dry contact closure between the status input pin number and common.

11.2.1 INPUTS

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
1	Live or fixed density	LV DENSITY	60 59 (GND)	Open, means use live density Shorted, means calculate density
2	Live or fixed energy	LV ENERGY	61 52 (GND)	Open, means use live energy Shorted, means use fixed energy
18	Chromatograph option	CHROM	68 58 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

	CH 1	CH 2	CH 18
Live SG and HV	No jumper	No jumper	No jumper
Fixed SG and HV	Jumper/GND	Jumper/GND	No jumper
Serial Chromatograph	Jumper/GND	Jumper/GND	Jumper/GND

Note that serial chromatograph inputs require that SG and HV be jumpered to ground as if fixed.

11.2.2 OUTPUTS

NOTE: All output signals from a SolarFlow Plus unit installed in a hazardous location must be isolated by means of intrinsic safety barriers.

This application has two form-A relays (mounted on the SolarFlow Plus PC board) that provide digital outputs for corrected station volume on Channels 5 and 6. The volume per pulse and the pulse period of the relays may be changed using the HHDT. Prompts for changing the relay volume per pulse (VPP1 and VPP2) and pulse period (PP1 and PP2) are included in the discussion of the CONTROL submenu of the SETUP UNIT menu, section 11.4.7.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	15 16	Form-A relay Common
6	Volume pulse output 2	VP2	17 18	Form-A relay Common

TTL level outputs for the following channels are available at the termination board pin numbers shown in the following table.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
5	Volume pulse output 1	VP1	78 76	TTL Output Common
6	Volume pulse output 2	VP2	79 70	TTL Output Common
7	Valve control open	OPEN 2	80 75	TTL Output Common
8	Valve control close	CLOSE 2	81 74	TTL Output Common

11.2.3 ANALOG OUTPUT CONNECTIONS

This application provides two 1-5 VDC analog outputs.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	SIGNAL TYPE
27	Flow rate output	FLW RT OUT	3 4	Analog output 1 Ground
28	Valve positioning	VALVE POS	1 2	Analog output 2 Ground

11.2.4 CHROMATOGRAPH INTER-CONNECTIONS

For more detail in wiring the Model 2252 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 systems Reference Manual.

MODEL 2252	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out Serial in Ground	102 103 106	DI in DI out DI ground

11.3 SETUP LOCATION MENU

The SolarFlow Plus operating parameters for the ISO-5167V bidirectional dual orifice meter application that can be changed in the SETUP LOCATION menu are shown in the following table described by the HHDT prompt for the parameter, the factory-installed default value, and a blank space for entering the desired value if different from the factory default. Additional information on the SETUP LOCATION menu is provided in section 5.10.1 of the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT	DESIRED
LOC NAME	BLANK LOCATION	_____
LOC ID	0	_____
DATE	010180 MMDDYY	_____
WEEK DAY	1 (1-7)	_____
TIME	0000 HHMM	_____
SEC CODE(1)	120	_____
USER REP(2)	****	_____
PCOMM RATE(3)	300 BPS	_____
RTS DELAY(4)	0 1/100s	_____

NOTES:

(1) Refer to section 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.

(2) Refer to section 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt. Refer to section 11.8, this manual, for default listing.

(3) Refer to section 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.

(4) Refer to section 5.10.1.9 in the Model 2470 System Reference Manual for a complete discussion of the RTS DELAY prompt.

11.4 SETUP UNIT MENU

The parameters for the ISO-5167V bidirectional dual orifice meter application of SolarFlow Plus that can be changed in the submenus of the SETUP UNIT menu using the HHDT are tabulated as follows. The SETUP MENU has eight submenus: GENERAL, ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, AND CALC DATA. The parameters are tabulated by the HHDT prompt for the parameter, the factory-installed default, and a blank space for entering the desired value if different from the factory default.

11.4.1 GENERAL SUBMENU

The following parameters can be changed in the GENERAL submenu of the SETUP UNIT menu of the HHDT.

HHDT PROMPT	DEFAULT	DESIRED
UNIT NAME	BLANK UNIT	_____
UNIT ID	BLANK-ID	_____
CONTRCT HR	7 (0-23)	_____
LOG INTRVL	1 HOUR	_____
LOG DEFINE(1)		_____
RESET CMOD(2)	OFF	_____

NOTES:

(1) All data logs in the SolarFlow Plus memory are automatically erased and can no longer be recovered any time a change is made in the LOG DEFINE menu. Refer to section 1.9 for a description of the LOG DEFINE prompt. Refer to section 11.9 for default listing.

(2) The RESET CMOD (Reset Calculations Module) prompt selects the calculation module for an alternate SolarFlow Plus application. RESET CMOD is discussed in detail in section 5.10.2.1.6 in the Model 2470 SolarFlow Plus System Reference Manual.

11.4.2 ANALOGS SUBMENU

The ANALOGS submenu of the SETUP UNIT menu of the ISO-5167V bidirectional dual orifice application provides for toggling between LIVE and FIXED values of the following analogs. The AUX1 key on the HHDT toggles the input between the fixed and live values. A fixed value is shown by an asterisk (*) following the analog value in the HHDT display. For additional information, refer to the Model 2470 System Reference Manual.

HHDT PROMPT	DEFAULT
METR PRES	xxxxx KPa
METR TEMP	xxxxx DEG C
DIFF PRES1	xxxxx KPa
DIFF PRES2	xxxxx KPa
AUX ANLG 7	xxxxx
BATTERY	xxxxx VOLTS
LV DENSITY	xxxxx Kg/M3
LV ENERGY	xxxxx MJ/M3
FLW RT OUT	xxxxx M3/HR
VALVE POS	xxxxx %

11.4.3 SCALES SUBMENU

The high- and low-scale values for the analogs shown in the following table can be modified in the SCALES submenu of the SETUP UNIT menu. Refer to section 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

HHDT PROMPT	DEFAULT		DESIRED
M PRES1/LO	0.0	KPa	_____
M PRES1/HI	6900.0	KPa	_____
M TEMP/LO	-18.0	DEG C	_____
M TEMP/HI	66.0	DEG C	_____
D PRES1/LO	0.0	KPa	_____
D PRES1/HI	37.50	KPa	_____
D PRES2/LO	0.0	KPa	_____
D PRES2/HI	37.5	KPa	_____
AUX 7 LOW	0.0	%	_____
AUX 7 HI	100.0	%	_____
DENSITY LO	0.0	Kg/M3	_____
DENSITY HI	100.0	Kg/M3	_____
ENERGY LO	0.0	MJ/M3	_____
ENERGY HI	100.0	MJ/M3	_____
FLW RT LOW	0	M3/HR	_____
FLW RT HI	50000	M3/HR	_____
VLV POS LO	0.0	%	_____
VLV POS HI	100.0	%	_____

11.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
OPEN 2 *	ON
CLOSE 2 *	OFF
OPEN 3 *	ON
CLOSE 3 *	OFF
OUTPUT 13	OFF
OUTPUT 14	OFF
OUTPUT 15	OFF

* Not used for this application.

11.4.5 CONFIG SUBMENU

The following default parameters can be changed in the CONFIG submenu of the SETUP UNIT menu. Refer to section 5.10.2.4 in the Model 2470 System Reference Manual for additional information about the CONFIG submenu.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
ORIF DIAM1	100.0	MM	_____
PIPE DIAM1	200.0	MM	_____
ZFLOW LIM1	0.10	KPa	_____
TAP LCTN 1	0		_____
TAP TYPE 1	0		_____
ORIF DIAM2	100.0	MM	_____
PIPE DIAM2	200.0	MM	_____
ZFLOW LIM2	0.10	KPa	_____
TAP LCTN 2	0		_____
TAP TYPE 2	0		_____
ATMS PRES	101.325	KPa	_____
PRES BASE	101.325	KPa	_____
TEMP BASE	15.0	DEG C	_____
AGA8 MTHD	0		_____
SG SELECT	1		_____
ORIF MTRL	1		_____
PIPE MTRL	0		_____
TREF ORIF	20.0	DEG C	_____
TREF PIPE	20.0	DEG C	_____
CHROM ADDR	1		_____
CHROM STRM	1		
VERSION	2.4		

11.4.6 GAS DATA

This ISO-5167V SolarFlow Plus software can accept information from the Model 2252 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 59 on the termination board. In addition, the MODBUS communication address and the chromatograph stream No. desired must be programmed in by the HHDT (CONFIG SUBMENU). The Solarflow Plus will then poll the chromatograph once every four minutes automatically. Refer to section 1.5.

HHDT PROMPT	**SAMPLE VALUES**		**DESIRED**
SPEC GRAV	0.6000		_____
HEAT VALUE	36.251	MJ/M3	_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
VISCOSITY	0.010268	cP	_____
SPEC HEAT	1.30		_____
METHANE	95.000	MOL%	_____
ETHANE	5.000	MOL%	_____
PROPANE	0.000	MOL%	_____
H2O	0.000	MOL%	_____
H2S	0.000	MOL%	_____
HYDROGEN	0.000	MOL%	_____
CO	0.000	MOL%	_____
OXYGEN	0.000	MOL%	_____
I-BUTANE	0.000	MOL%	_____
BUTANE	0.000	MOL%	_____
I-PENTANE	0.000	MOL%	_____
PENTANE	0.000	MOL%	_____
HEXANE	0.000	MOL%	_____
HEPTANE	0.000	MOL%	_____
OCTANE	0.000	MOL%	_____
NONANE	0.000	MOL%	_____
DECANE	0.000	MOL%	_____
HELIUM	0.000	MOL%	_____
ARGON	0.000	MOL%	_____

11.4.7 CONTROL SUBMENU

The CONTROL submenu of the SETUP UNIT menu provides for entering the control values primarily for the valve positioning and tube switching. Refer to sections 1.6 and 1.7 for more information.

HHDT PROMPT	DEFAULT		DESIRED
VPP 1	1000	M^3	_____
PP 1	1	SEC	_____
VPP 2	1000	M^3	_____
PP 2	1	SEC	_____
VP MODE	0		_____
FLW SETPNT	0	M3/HR	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5	%	_____
PRES CHAN#	20		_____
OVRD PRESS	0	KPa	_____
DP LIMIT	0	KPa	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALVE POS	50.0	%	_____

11.4.8 CALCULATED DATA

The CALC DATA submenu of the SETUP UNIT menu allows the user to determine the calculated values for specified application inputs. The values shown here are typical values and not default values.

HHDT PROMPT	SAMPLE VALUES	
AGA8 MTHD	0	
ZS	0.997811	
DENSITY-B	0.8050	Kg/M3
FLOW RATE1	0	M3/HR
FLOW RATE1	0.00	TON/H
EV 1	1.03164	
CD 1	0.603166	
Y FCTR 1	0.999892	
FLW EXTN 1	94.841	
DENSITY-F1	5.327	Kg/M3
FLOW RATE2	0	M3/HR
FLOW RATE2	0.00	TON/H
EV 2	1.0000	
CD 2	0.600000	
Y FCTR 2	1.000000	
FLW EXTN 2	0.000	
DENSITY-F2	1.000000	Kg/M3
B - AGA8	0.033417	
C - AGA8	0.002236	
D - AGA8	0.266296	
K - AGA8	0.100912	
MOL WT.	16.7444	

11.5 DISPLAY MENU

The DISPLAY Menu of the HHDT provides for viewing the various setup parameters and calculated values in a SolarFlow Plus unit at any given time. The menu is for display purposes only. No changes can be made to the values displayed using this menu. The Display menu has eight selections: ANALOGS, SCALES, DISCRETES, CONFIG, GAS DATA, CONTROL, CALC DATA and RATE/VOLS.

11.5.1 ANALOGS

METR PRES	(KPa)
METR TEMP	(DEG C)
DIFF PRES1	(KPa)
DIFF PRES2	(KPa)
AUX ANLG 7	(%)
BATTERY	(VOLTS)
LV DENSITY	(Kg/M3)
LV ENERGY	(MJ/M3)
FLW RT OUT	(M3/HR)
VALVE POS	(%)

11.5.2 SCALES

M PRES/LO	(KPa)	ENERGY LO	(MJ/M3)
M PRES/HI	(KPa)	ENERGY HI	(MJ/M3)
M TEMP/LO	(DEG C)	FLW RT LOW	(M3/HR)
M TEMP/HI	(DEG C)	FLW RT HI	(M3/HR)
D PRES1/LO	(KPa)	VLV POS LO	(%)
D PRES1/HI	(KPa)	VLV POS HI	(%)
D PRES2/LO	(KPa)		
D PRES2/HI	(KPa)		
AUX 7 LOW	(%)		
AUX 7 HI	(%)		
DENSITY LO	(Kg/M3)		
DENSITY HI	(Kg/M3)		

11.5.3 DISCRETES

LV DENSITY
LV ENERGY
CHROM
VP 1
VP 2
OPEN 2
CLOSE 2
INPUT 3
INPUT 4
INPUT 9
INPUT 10
INPUT 16
INPUT 17
OPEN 3
CLOSE 3
OUTPUT 13
OUTPUT 14
OUTPUT 15

11.5.4 CONFIG

ORIF DIAM1	(MM)	ORIF MTRL	
PIPE DIAM1	(MM)	PIPE MTRL	
ZFLOW LIM1	(KPa)	TREF ORIF	(DEG C)
TAP LCTN 1		TREF PIPE	(DEG C)
TAP TYPE 1		CHROM ADDR	
ORIF DIAM2	(MM)	CHROM STRM	
PIPE DIAM2	(MM)	VERSION	
ZFLOW LIM2	(KPa)		
TAP LCTN2			
TAP TYPE 2			
ATMS PRES	(KPa)		
PRES BASE	(KPa)		
TEMP BASE	(DEG C)		
AGA8 MTHD			
SG SELECT			

11.5.5 GAS DATA

SPEC GRAV	
HEAT VALUE	(MJ/M3)
CO2	(MOL%)
N2	(MOL%)
VISCOSITY	(cP)
SPEC HEAT	
METHANE	(MOL%)
ETHANE	(MOL%)
PROPANE	(MOL%)
H20	(MOL%)
H2S	(MOL%)
HYDROGEN	(MOL%)
CO	(MOL%)
OXYGEN	(MOL%)
I-BUTANE	(MOL%)
BUTANE	(MOL%)
I-PENTANE	(MOL%)
PENTANE	(MOL%)
HEXANE	(MOL%)
HEPTANE	(MOL%)
OCTANE	(MOL%)
NONANE	(MOL%)
DECANE	(MOL%)
HELIUM	(MOL%)
ARGON	(MOL%)

11.5.6 CONTROL

VPP 1	(M^3)
PP 1	(SEC)
VPP 2	(M^3)
PP 2	(SEC)
VP MODE	
FLW SETPNT	(M3/HR)
DEADBAND	(%)
SMALL STEP	(%)
LARGE STEP	(%)
FINE CNTRL	(%)
PRES CHAN#	
OVRD PRESS	(KPa)
DP LIMIT	(KPa)
PRESET POS	(%)
UPDATE TIM	(SECS)
VALVE POS	(%)

11.5.7 CALC DATA

AGA8 MTHD
ZS
DENSITY-B (Kg/M3)
FLOW RATE1 (M3/HR)
FLOW RATE1 (TON/H)
EV 1
CD 1
Y FCTR 1
FLW EXTN 1
DENSITY-F1 (Kg/M3)
FLOW RATE2 (M3/HR)
FLOW RATE2 (TON/H)
EV 2
CD 2
Y FCTR 2
FLW EXTN 2
DENSITY-F2 (Kg/M3)
B - AGA8
C - AGA8
D - AGA8
K - AGA8
MOL WT.

11.5.8 RATE/VOLS

This application shows station flow rates and volumes as meter run No. 1 minus meter run No. 2.

FLOW RATE1	(M3/HR)	ST TDY VOL	(TONS)
FLOW RATE1	(M3/DY)	ST YSY VOL	(TONS)
TODAY VOL1	(M^3)	ST TOT VOL	(TONS)
YSDAY VOL1	(M^3)		
TOT VOL 1	(M^3)		
FLOW RATE2	(M3/HR)		
FLOW RATE2	(M3/DY)		
TODAY VOL2	(M^3)		
YSDAY VOL2	(M^3)		
TOT VOL 2	(M^3)		
STN FLW RT	(M3/HR)		
STN FLW RT	(M3/DY)		
ST TDY VOL	(M^3)		
ST YSY VOL	(M^3)		
ST TOT VOL	(M^3)		
ERATE 1	(GJ/HR)		
TDY ENRGY1	(GJ)		
YSY ENRGY1	(GJ)		
TOT ENRGY1	(GJ)		
ERATE 2	(GJ/HR)		
TDY ENRGY2	(GJ)		
YSY ENRGY2	(GJ)		
TOT ENRGY2	(GJ)		
STN ERATE	(GJ/HR)		
TDY ENERGY	(GJ)		
YSY ENERGY	(GJ)		
TOT ENERGY	(GJ)		
FLOW RATE1	(TON/H)		
TODAY VOL1	(TONS)		
YSDAY VOL1	(TONS)		
TOT VOL 1	(TONS)		
FLOW RATE2	(TON/H)		
TODAY VOL2	(TONS)		
YSDAY VOL2	(TONS)		
TOT VOL 2	(TONS)		
STN FLW RT	(TON/H)		

11.6 CALIBRATE UNIT MENU

The CALIBRATE UNIT menu provides for calibrating the SolarFlow Plus input circuitry to match the outputs of the transmitters for analog inputs to the SolarFlow Plus unit. The CALIBRATE UNIT menu has three selections: PRESSURES, TEMP and OTHERS. Refer to section 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

11.6.1 PRESSURES

The PRESSURES selection of the CALIBRATE UNIT menu provides for calibrating the pressure inputs listed as follows:

METR PRES
DIFF PRES1
DIFF PRES2

11.6.2 TEMPERATURE

The TEMP selection of the CALIBRATE UNIT menu provides for calibrating the METR TEMP selection.

11.6.3 OTHERS

The analog inputs listed as follows are calibrated in the OTHERS submenu of the CALIBRATE UNIT MENU:

AUX ANLG 7
LV DENSITY
LV ENERGY

11.7 MONITOR MENU

The MONITOR menu provides for witness testing analog inputs to the SolarFlow Plus unit. When the MONITOR menu is entered, all analog inputs are fixed at the values being transmitted to SolarFlow Plus when MONITOR is executed. The values remain fixed until the MONITOR menu is exited. The following analog inputs listed are available in the MONITOR menu in the triple orifice application. Refer to section 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES
METR TEMP
DIFF PRES1
DIFF PRES2
AUX ANLG 7
LV DENSITY
LV ENERGY

11.8 USER REPORT (CHANNEL 0)

Channel zero (0) is a predefined report list containing a report header and the channel data shown in the following table. The SolarFlow Plus unit displays the Users Report on the front panel in a scrolling format. Refer to section 11.3, "USER REP".

CHANNEL NUMBER	CHANNEL LABEL	DESCRIPTION
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in KPa
022	FLOW TEMP1	Live temperature in degrees Celsius (ºC)
023	DIFF PRES1	Live DP, Run No.1, value in kilopascals
024	DIFF PRES2	Live DP, Run No.2, value in kilopascals
021	AUX ANLG 3 (LV DENSITY)	Live value for density
134	FLOW RATE1	Flow rate for meter No.1
139	TOT VOL 1	Total volume for meter No.1
164	FLOW RATE2	Flow rate for meter No.2
169	TOT VOL 2	Total volume for meter No.2
213	ST TDY VOL	Station today's volume for meter No.1 minus meter No.2
214	YSDAY VOL	Station yesterday's volume for meter No.1 minus meter No.2

11.9 DATA LOG LIST CONTENTS

The following are default items included on the data log. Refer to section 11.4.1, "LOG DEFINE". The data log is set to a 1-hour log interval. The default contract hour is 7:00 AM.

CHANNEL NUMBER	CHANNEL LABEL	DECIMAL PLACES	DIGITS	LOGGING TYPE
023	DIFF PRES1	2	6	AVERAGE
020	METR PRES	1	6	AVERAGE
022	FLW TEMP	1	4	AVERAGE
133	FLW TIME 1	1	6	SNAPSHOT & ZERO
132	FLW EXTN 1	3	6	AVERAGE
136	LOG VOL1	0	8	SNAPSHOT & ZERO
146	LOG VOL1	2	6	SNAPSHOT & ZERO
024	DIFF PRES2	2	6	AVERAGE
163	FLW TIME 2	1	6	SNAPSHOT & ZERO
162	FLW EXTN 2	3	6	AVERAGE
166	LOG VOL2	0	8	SNAPSHOT & ZERO
176	LOG VOL2	2	6	SNAPSHOT & ZERO

11.10 DATA LOG HEADER BLOCK CONTENTS

The data log header block includes the following items for use on the data log:

M PRES/LO
M PRES/HI
M TEMP/LO
M TEMP/HI
D PRES1/LO
D PRES1/HI
D PRES2/LO
D PRES2/HI
ORIF DIAM1
PIPE DIAM1
ZFLOW LIM1
TAP LCTN 1
TAP TYPE 1
ORIF DIAM2
PIPE DIAM2
ZFLOW LIM2
TAP LCTN 2
TAP TYPE 2
ATMS PRES
PRES BASE
TEMP BASE

(Continued on the next page.)

Data Log Header Block (Continued)

AGA8 MTHD
SG SELECT
ORIF MTRL
PIPE MTRL
TREF ORIF
TREF PIPE
SPEC GRAV
HEAT VALUE
CO2
N2
VISCOSITY
SPEC HEAT
METHANE
ETHANE
PROPANE
H2O
H2S
HYDROGEN
CO
OXYGEN
I-BUTANE
BUTANE
I-PENTANE
PENTANE
HEXANE
HEPTANE
OCTANE
NONANE
DECANE
HELIUM
ARGON

11.11 ALARM DEFINITIONS

The following is a listing of the Alarm definitions for this application. Note that the alarms will show up in the event log.
Number of Retries: 5 for alarms 1 through 9, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	C(19) < X	LOW BATTER	16.0	10.8	0.0	0
2	C(20) < X*S(20,F) or C(20) > Y*S(20,F)	METR PRES1	6900.0	0.0	1.01	0
3*	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	LIVE SG (LV DENSITY)	50.0	0.0	1.01	0
4	C(22) < X*S(22,F) or C(22) > Y*S(22,F)	FLW TEMP1	66.0	0.0	1.01	0
5	C(23) < X*S(23,F) or C(23) > Y*S(23,F)	DIFF PRES1	37.5	0.0	1.01	0
6	C(24) < X*S(24,F) or C(24) > Y*S(24,F)	DIFF PRES2	37.5	0.0	1.01	0
7*	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	AUX ANLG7	-	0.0	1.01	0
8*	C(26) < X*S(26,F) or C(26) > Y*S(26,F)	LV ENERGY	45.0	0.0	1.01	0
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	99999999	0
10	C(30) <> 0.0	SYS ERROR	-	0.0	0.0	0

* These alarms should be disabled.

EXAMPLE:

Alarm # 2

Y	=	1.01
S(20,F)	=	The full-scale value for channel 20, which is the static pressure transmitter. SolarFlow Plus automatically generates this value based on the full-scale value entered while in the SETUP UNIT submenu.
F	=	6900 KPa

Therefore, the alarm setpoint for alarm #2 is 1.01(6900) = 6969 KPa.

When the ALARM menu is entered using the HHDT the user may modify the X, Y, or Z values shown in the above alarm conditions by changing the values for LOW, HIGH, and ALT. This enables the user to adjust the alarm limit(s) to match the requirements.

The value for X is represented by LOW on the HHDT ALARM SETUP menu. The value for Y is represented by HIGH on the HHDT ALARM SETUP menu. The value for Z is represented by ALT on the HHDT ALARM SETUP menu.

The ALARM menu is also used to acknowledge alarms and to activate or deactivate alarms.

To acknowledge an alarm condition displayed on the LCD of SolarFlow Plus, enter the ALARM menu of the HHDT and select the ACKNOWLEDGE sub-menu. Any existing unacknowledged alarms are displayed and the HHDT prompts: "ACKNOWLEDGE ? Y/N". Press the ENTER key to acknowledge the alarm. Once this has been done and the user has logged off SolarFlow Plus the activated alarm is displayed with the message "ACKNOWLEDGED" following the alarm condition. If the alarm condition no longer exists and has not been acknowledged it remains on the LCD until acknowledged.

To activate or deactivate alarms, enter the HHDT ALARM menu and select the SETUP sub-menu. The HHDT displays the various alarms that are available in the program. Scroll to the desired alarm and press the ENTER key at the desired alarm condition. The HHDT provides four options; STAT, LOW, HIGH, and ALT. Press ENTER at the STAT option. The HHDT shows either ON or OFF and prompts OK?. To turn off the alarm, press the NO key until OFF is displayed, then press ENTER.

WARRANTY CLAIM REQUIREMENTS

To make a warranty claim, you, the Purchaser, must:

1. Provide Daniel with proof of the Date of Purchase and proof of the Date of Shipment of the product in question.

2. Return the product to Daniel within twelve (12) months of the date of original shipment of the product, or within eighteen (18) months of the date of original shipment of the product to destinations outside of the United States. The Purchaser must prepay any shipping charges. In addition, the Purchaser is responsible for insuring any product shipped for return, and assumes the risk of loss of the product during shipment.

3. To obtain Warranty service or to locate the nearest Daniel office, sales, or service center call (281) 897-2900, Fax (281) 897-2901, or contact:

   Daniel Measurement Services
   19203 Hempstead Highway
   Houston, Texas 77065

   When contacting Daniel for product service, the purchaser is asked to provide information as indicated on the following "Customer Problem Report".

   Daniel Measurement Services offers both on call and contract maintenance service designed to afford single source responsibility for all its products.

   Daniel Industries, Inc. reserves the right to make changes at any time to any product to improve its design and to insure the best available product.

DANIEL INDUSTRIES, INC.
CUSTOMER PROBLEM REPORT

FOR FASTEST SERVICE, COMPLETE THIS FORM, AND RETURN IT ALONG WITH THE AFFECTED EQUIPMENT TO CUSTOMER SERVICE AT THE ADDRESS INDICATED BELOW.

COMPANY NAME:_____

TECHNICAL CONTACT:_____ PHONE:_____

REPAIR P. O. #:_____ IF WARRANTY, UNIT S/N: _____

INVOICE ADDRESS:_____

_____

_____

SHIPPING ADDRESS:_____

_____

_____

RETURN SHIPPING METHOD:_____

EQUIPMENT MODEL #:_____ S/N:_____FAILURE DATE: _____

DESCRIPTION OF PROBLEM: _____

_____

_____

WHAT WAS HAPPENING AT TIME OF FAILURE?_____

_____

ADDITIONAL COMMENTS: _____

_____

_____

REPORT PREPARED BY:_____ TITLE:_____

IF YOU REQUIRE TECHNICAL ASSISTANCE, PLEASE FAX OR WRITE THE MAIN CUSTOMER SERVICE DEPARTMENT AT:

DANIEL MEASUREMENT SERVICES
ATTN: CUSTOMER SERVICE
19203 HEMPSTEAD HIGHWAY
HOUSTON, TEXAS 77065

PHONE: (281) 897-2900
FAX: (281) 897-2901

THIS DIGITAL APPARATUS DOES NOT EXCEED THE CLASS A LIMITS FOR RADIO NOISE EMISSIONS FROM DIGITAL APPARATUS AS SET OUT IN THE RADIO INTERFERENCE REGULATIONS OF THE CANADIAN DEPARTMENT OF COMMUNICATIONS.

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The sales and service offices of Daniel Industries, Inc. are located throughout the United States and in major countries overseas. Please contact Daniel Measurement Services at 19203 Hempstead Highway, Houston, Texas 77065, or phone (281) 897-2900 for the location of the sales or service office nearest you. Daniel Measurement Services offers both on-call and contract maintenance service designed to provide single-source responsibility for all Daniel Measurement and Control products.

Daniel Measurement and Control reserves the right to make changes to any of its products or services at any time without prior notification in order to improve that product or service and to supply the best product or service possible.

DANIEL