

# MODEL 2470 SOLARFLOW PLUS

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## **ENHANCED SOLARFLOW PLUS FOR TURBINE/PD INSTALLATIONS APPLICATION MANUAL**

HHDT EPROM 8-2460-239  
LD EPROM 8-2460-240  
LC EPROM 8-2460-241

**Part Number 3-9003-151  
Revision G**

**MAY 1999**

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**DANIEL**

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**DANIEL INDUSTRIES, INC.  
MODEL 2470 SOLARFLOW PLUS  
ENHANCED SOLARFLOW PLUS  
FOR TURBINE/PD INSTALLATIONS  
APPLICATION MANUAL**

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**1.0 INTRODUCTION**

The Model 2470 Enhanced 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. Even with the enhanced features, field upgrades of existing units will be simple and easy. There are minimal or no hardware changes. This enhanced software will calculate rates and volumes using equations shown in paragraph 1.4.

**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 four turbine/PD 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 four 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 four different turbine/PD 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 enhanced 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 Enhanced Model 2470 SolarFlow Plus software are as follows:

- Serves as a single or dual turbine / PD meter application
- Supports AGA-8 according to the new standard (both detail and gross methods)
- Accepts a variety of transducer assignments, including 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
- Provides a discrete output to indicate that a user-selected process variable has violated the programmed limits.
- Supports tube switching for configurations with more than one meter run
- Performs valve positioning using an analog output to control corrected station flow rate
- Offers an analog output proportional to corrected station flow rate (user scalable)
- Provides two contact closure pulse outputs based on corrected 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 four applications. If a particular application does not use a particular feature, that feature should be ignored.

**1.3 ENHANCED TURBINE/PD APPLICATIONS**

The following enhanced applications are included in this manual. The former closest equivalent applications are included for reference.

<b>NEW APPLICATION</b>	<b>PREVIOUS ANALOGOUS APPLICATION</b>	
SNGL AGA7E	AGA7 SNGL	8-2460-124/125
DUAL AGA7E 2P2T	AGA7 DUAL	8-2460-124/125
DUAL AGA7E 2P1T	none - new application	
DUAL AGA7E 1P1T	none - new application	

The acronym "2P2T" refers to the number of pressure and temperature transducers, i.e. "2P2T" means two pressure and two temperature transducers. 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 BTU input. See the section on channel assignments.

## 1.4 CALCULATIONS

The calculations in the SolarFlow Plus are divided into two distinct processes. These are as follows:

- Analog input sampling and uncorrected rate calculation
- Volume and corrected flow rate calculation cycle

These processes are usually operating autonomously without regard for the state of the other. Only when the volume 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 AND UNCORRECTED RATE CALCULATION

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 four inputs to be used in each configured meter run (i.e. eight averages total in a 2-run configuration). These values are flow averages for measured static pressure in PSIG, temperature, specific gravity (regardless of source), and BTU content (regardless of source).

A meter is considered to be flowing if the uncorrected flow rate for that meter is above zero. If no flow occurs for an entire calculation cycle, straight averages are kept for all inputs.

Each 0.5 seconds, the uncorrected flow rates for each configured meter are updated. The uncorrected flow rate is:

$$Q_u = (\text{PULSES})/(\text{METER FACTOR} * T_r)$$

where

$Q_u$  = Uncorrected rate in actual cubic feet/h (ACF/H)

Pulses = The number of pulses used in rate calculation

Meter Factor = In pulses per actual cubic foot/hour (PP/CF)

$T_r$  = Time in hours over which the pulses were received  
 $T_r$  may vary between 2.5 and 60 seconds.

SolarFlow Plus attempts to provide the best rate approximation possible while still providing a responsive uncorrected rate value. At very low input frequencies the rate is smoothed over as much as 60 seconds; at frequencies above approximately 160 Hz the rate is smoothed over a period of 2.5 seconds. The approximate uncertainty and bounce in the uncorrected rate value is shown vs. frequency as follows:

<u>Frequency</u>	<u>Uncertainty</u>
< 2 pulses/minute (ppm) N/A -- rate = 0.0	
2-4 ppm	~ 3%
4-10 ppm	< 2%
10 ppm - 6.5 Hz	~ 1%
6.5 Hz - 160 Hz	≤ 0.25%
> 160 Hz	< 0.25%



1.4.2 FLOW RATE EQUATIONS

The SolarFlow Plus calculates volumetric flow rate using the following equations:

$$Q_b = 0.001 * Q_u * CF \text{ (correction factor)}$$

$$V_u = PP / \text{(meter factor)}$$

$$V_c = V_u * CF$$

$$CF = \frac{(P_f + P_{atm})}{(P_b)} * \frac{(T_b + 459.67)}{(T_f + 459.67)} * \frac{Z_b}{Z_f}$$

where :

- $Q_b$  = volumetric flow rate in MCFH at base conditions
- $V_u$  = uncorrected volume this cycle
- $V_c$  = corrected volume this cycle
- CF = correction factor
- $P_b$  = base pressure in PSIA
- $P_{atm}$  = atmospheric pressure in PSIA
- $P_f$  = line pressure in PSIG
- $Z_b$  = gas compressibility at base conditions
- $Z_f$  = gas compressibility at flowing conditions
- $T_f$  = flowing temperature in DEG F
- $T_b$  = base temperature in DEG F
- pp = pulses received this calculation cycle

All compressibility 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 compressibility 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 14.73 PSIA and 60 °F. This assumption is consistent with calculation examples given in API Chapter 14.3, Part 3. If the operator indicates that the input gravity is the ideal relative density, the ideal value is converted to  $G_r$  before the flow rate calculation is run. This value is internal to the flow rate calculation, and does not replace the specific gravity value in the SolarFlow Plus channels.

### 1.4.3 RATE AND VOLUME CALCULATION

The SolarFlow Plus recalculates rates, volumes, and compressibility 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:

<b>NUMBER OF METERS</b>	<b>AGA-8 DETAIL</b>	<b>AGA-8 GROSS (SHORT FORM)</b>
1	20 SEC	10 SEC
2	60 SEC	15 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 compressibility 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 2251 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 retried in four minutes. Next a poll is issued for the BTU content and specific gravity, followed by a poll for the 11 component values supported by the Model 2251. 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 ( $SG > 2.0$ ,  $SG < 0.4$ ,  $N_2 > 50$ ,  $BTU > 2000$  or  $BTU < 400$ ), 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)
BTU Content	7033

If the retrieved value for Nitrogen exceeds 50 percent, or the specific gravity is outside the range of 0.4 to 2.0, or the BTU content is outside the range of 400 to 2000 BTU/CF, 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 2251 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.

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 2251 in the calculation of the reported value for BTU content.

If the SolarFlow Plus has a prolonged communication error (greater than 6 minutes) with the Model 2251, miscellaneous fault bit number four is set.

## **1.6 CHANNEL VALUE MONITOR FUNCTION**

The Channel Value Monitor Function provides a status output indicating that the monitored channel has exceeded the user-defined limits. Four channels are used to support this function including CVM STATUS on CH-13, CVM CHAN # on CH-110, CVM LO LIMIT on CH-111 and CVM HI LIMIT on CH-112.

CVM CHAN # indicates which channel holds the process variable value to be monitored. The function is disabled by selecting "0" for the "CVM CHAN #", and enabled by entering the channel number of the variable to be monitored. The process variable may be an analog input or calculated value (such as rate or volume).

Every 0.5 second, the value of the monitored process variable value is compared to the high and low limits. If the value is outside the limits, the CVM STATUS is turned ON. When the value of the monitored process variable returns within the user-defined limits for 60 seconds, the CVM status channel returns to the OFF condition.

## **1.7 TUBE SWITCHING**

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

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 uncorrected flow rate on the control run is examined. If it exceeds the set point to open the next tube, that tube is opened and it becomes the new control run. If the uncorrected flow rate falls below the close set point, 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 uncorrected flow rate must remain above or below the switching set point before the control will occur.

For example, if the delay is 30 seconds and uncorrected flow rate on the control run rises above the open set point for only five seconds and then decreases again, no control will occur. The same delay applies to close set points as to open set points. 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.

**1.8 VALVE POSITIONING**

The SolarFlow Plus provides flow control based on rate, pressure or rate with pressure over-ride and also supports uncorrected flow rate 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 4=pres control w/upstrm valve 5=pres control w/dnstrm valve
Flow set point	desired flow rate in MCFH
Deadband	in % of set point
Small step	step for fine control
Large step	step for fast control
Fine control error limit	in % of set point
Over-ride pressure channel #	analog channel #
Over-ride pressure	in PSIG
Uncorrected flow rate over-range limit	in ACF/H
Preset valve position	valve position for uncorrected flow rate over-ride
Update time in seconds	valve positioning update time

If the function is disabled, or any analog input is under calibration, or there has been an error in the flow calculation, 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.

### 1.8.1 UNCORRECTED FLOW RATE OVER-RANGE PROTECTION

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

Each 0.5 seconds, the uncorrected flow rate on the primary meter run is compared to the over-range limit. If the uncorrected flow rate is below the over-range limit, valve positioning continues based on the selected mode. If the uncorrected flow rate 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.

### 1.8.2 FLOW RATE CONTROL (VP MODE = 1)

SolarFlow Plus attempts to cause the measured flow rate to match a user entered flow rate set point. 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 set point. 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 set point	500 MCFH
Small step	0.1 %
Deadband	1 %
Large step	0.3 %
Fine control	
Error limit	5 %

If the observed flow rate is below 475 MCFH, 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 MCFH, 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 MCFH, 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 uncorrected flow rates. This estimation is:

$$Q_{vp} = Q_{sys} * (Q_{u1} + Q_{u2}) / Q_{usys}$$

where:

$Q_{sys}$  = Station flow rate in MCFH from last calculation cycle

$Q_{u1}, Q_{u2}$  = Instantaneous uncorrected rates for meters 1 and 2

$Q_{usys}$  = Station uncorrected rate from last calculation cycle

### 1.8.3 FLOW RATE CONTROL WITH PRESSURE OVER-RIDE (VP MODE = 2 OR 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.

### 1.8.4 PRESSURE CONTROL - UP/DOWNSTREAM VALVES (VP MODE = 4 OR 5)

When the valve positioning is configured for pressure control, the 2470 attempts to make the measured pressure match the pressure set point. Channel 103 has been dedicated as the setpoint for pressure control. The channel on which the pressure is measured is the same "PRES CHAN#" which is used for the pressure override modes. The deadband applied for control is the same as for flow control, and is expressed in a percent of set point. Differential overrange protection may still be used, but no flow rate control is done in these modes.

The valve positioning algorithm runs at the operator defined interval specified by the update time. If the pressure is outside the deadband, but within the fine control limit, a small step is applied to the valve. If the pressure is outside the fine control limit, a large step is applied.

If the valve is upstream of the pressure transmitter, the 2470 closes the valve to lower the pressure (VP MODE = 4). If the valve is downstream of the pressure transmitter, the 2470 closes the valve to raise the pressure (VP MODE = 5).

### 1.8.5 FLOW RATE OUTPUT

SolarFlow Plus provides an analog output proportional to corrected station volumetric 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.

### 1.8.6 VOLUME PULSE OUTPUT

SolarFlow Plus provides two separate contact closure outputs based on corrected 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.

**1.9 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 paragraph 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.

## **1.10 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.

- \* Enhanced SolarFlow Plus software must use three digit channel assignments due to the 240 total channels.

## **1.11 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.

**1.12 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.

**1.13 HIGH SPEED CHANNEL READS**

This application supports high speed channel reads with DSI protocol.

## 1.14 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 paragraph 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	ON	PD meter No. 2 active
S1-2	OFF	Turbine meter No. 2 active
S3-1	ON	PD meter No. 1 active
S3-2	OFF	Turbine meter No. 1 active
S2-1	ON	Always ON
S2-2	N/A	Reserved for future use
S2-3	N/A	Reserved for future use
S2-4	N/A	Reserved

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

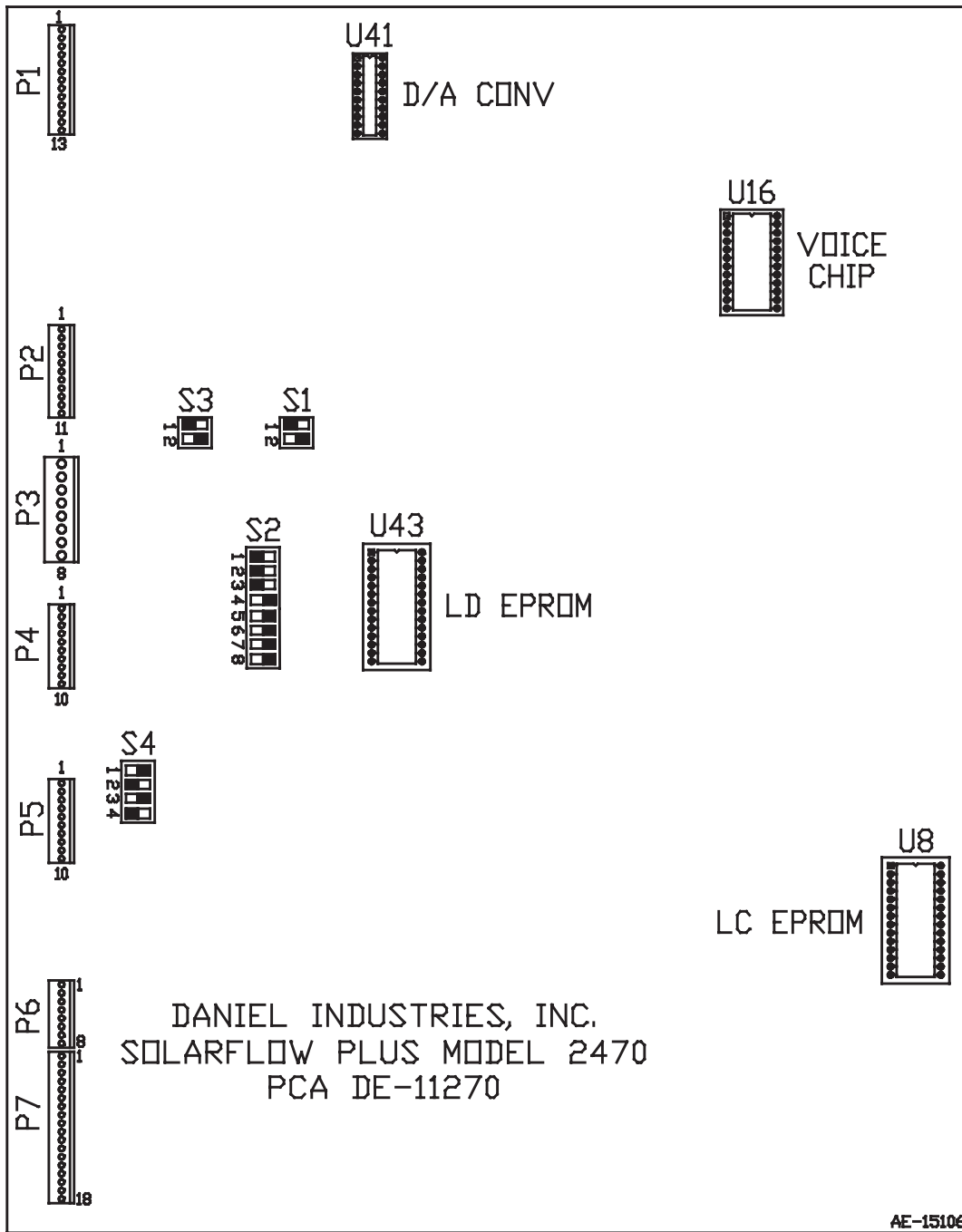


Figure 1. Model 2470 Slide Switch Locations  
(PC Board Assembly Part No. 3-2470-000)

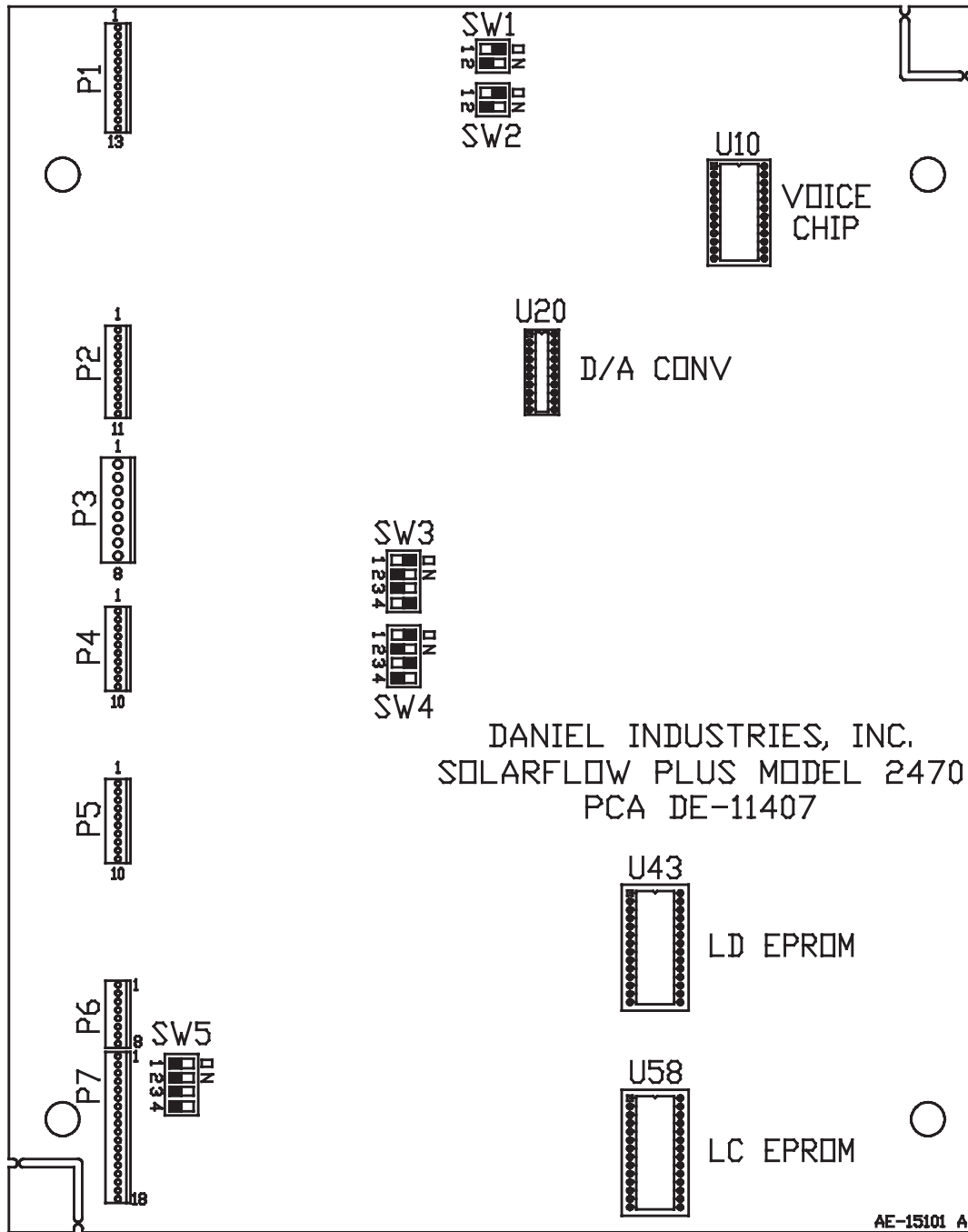


Figure 2. Model 2470 Slide Switch Locations  
(PC Board Assembly Part No. 3-2470-008)



1.14.1 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	ON	PD meter No. 2 active
SW1-2	OFF	Turbine meter No. 2 active
SW2-1	ON	PD Meter No. 1 active
SW2-2	OFF	Turbine meter No. 1 active
SW3-1	ON	Always ON
SW3-2	N/A	Reserved for future use
SW3-3	N/A	Reserved for future use
SW3-4	N/A	Reserved
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

**1.15 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:

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

The enhanced version of these miscellaneous bits is as follows:

<u>Dot No.</u>	<u>System Conditions</u>	<u>Weight in CH 30</u>
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.

## 2.0 ENHANCED SOLARFLOW PLUS CHANNEL ASSIGNMENTS

The enhanced SolarFlow Plus software features a comprehensive set of channels which should satisfy all of the expected applications with some room for future growth. The enhanced SolarFlow Plus supports 240 channels. The first 28 channels have the same special meanings 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 groups of channels for information specific to each of the 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 four 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 LIVE SG and/or LIVE BTU channels are not in use, that unused channel becomes available as an auxiliary. However, the HHDT will still describe the channel as LIVE SG or BTU.

The following list is a comprehensive channel list for all four 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.

<b>CH</b>	<b>LABEL</b>	<b>INPUT OUTPUT</b>	<b>0- LABEL</b>	<b>1- LABEL</b>	<b>DEFAULT</b>	<b>DESCRIP- TION</b>
001*	LIVE SG	INP	NO	YES	NO	Live gravity in use
002*	LIVE BTU	INP	NO	YES	NO	Live BTU in use
003	INPUT 3	INP	OFF	ON	ON	Spare status point
004	INPUT 4	INP	OFF	ON	ON	Spare status point
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	INPUT 9	INP	OFF	ON	ON	Spare status point
010	INPUT 10	INP	OFF	ON	ON	Spare status point
011	OPEN 3	OUT	ON	OFF	ON	Tube switching control

CH	LABEL	INPUT OUTPUT	0- LABEL	1- LABEL	DEFAULT	DESCRIP- TION
012	CLOSE 3	OUT	OFF	ON	OFF	Tube switching control
013	CVM STATUS	OUT	OFF	ON	OFF	CVM function
014	OUTPUT 14	OUT	OFF	ON	OFF	Spare status point
015	OUTPUT 15	OUT	OFF	ON	OFF	Spare status point
016 through 017 are reserved						
018	CHROM	INP	ENABL	DISAB	DISAB	Jumper installed enables GC**

\* LIVE SG for channel 001 indicates pin 59 not jumpered to pin 60. LIVE BTU for channel 002 indicates pin 52 not jumpered to pin 61.

\*\* To enable the serial gas chromatograph interface, install a jumper between pin 68 and pin 59 (ground). Install jumpers between pins 60 and 61 and ground as when SG and BTU are fixed.

**2.2 CHANNEL 19 THROUGH 240 ASSIGNMENTS**

Assignments for the Enhanced 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	MCF/H	1	0.0	Analog Flow Rate
028	VALVE POS	%	1	50.0	Current Valve Position
029	VERSION		1	1.0	Software version
030	SYS ERROR		0	0	System alarm
031-032	RESERVED			0	
033	ATMS PRES	PSIA	2	14.73	Atmospheric pressure
034	PRES BASE	PSIA	2	14.73	Pressure base
035	TEMP BASE	DEG F	0	60	Temperature base
036-041	RESERVED			0	
042	SG SELECT		0	0	Input Specific Gravity 0=ideal, 1=real
043	AGA8 MTHD		0	0	AGA-8 Method 0=detail 1=GR, CO2, BTU 2=GR, CO2, N2
044	ZS		6	1.000000	Standard compressibility
045	ZB		6	1.000000	Base compressibility
046	MOL WT		4	16.8000	Calculated by AGA-8

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
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	K3		6	0.000000	AGA-8 mixture size param
051	SPEC GRAV	(None)	4	0.6000	Current SG
052	BTU	(None)	1	1000.0	Current BTU
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	Hydrogen Sulphide MOL%
060	HYDROGEN	MOL%	3	0.000	Hydrogen MOL%
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%

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
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	MCF	1	100.0	Volume per pulse 1
077	PP 1	SEC	0	1	Pulse period 1
078	VPP 2	MCF	1	100.0	Volume per pulse 2
079	PP 2	SEC	0	1	Pulse period 2
080- 081	RESERVED			0	
082	TS ENABLE	(None)	0	0	0=disable, 1=enable
083- 086	RESERVED			0	
087	TS DELAY	SEC	0	30	Tube switching delay time
088	VALVE TIME	SEC	0	30	Valve travel time
089	OPEN 2 SP	ACF/H	1	4000.0	Valve 2 open set point
090	CLOSE 2 SP	ACF/H	1	1000.0	Valve 2 close set point



CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
091	VP MODE	(None)	0	0	Valve positioning option 0=disabled 1=flow rate control active 2=rate w/upstrm pres ovrd 3=rate w/dnstrm pres ovrd 4=pres control w/upstrm valve 5=pres control w/dnstrm valve
092	FLW SETPNT	MCF/H	1	0.0	Flow rate set point
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	PSIG	0	0	Press over-ride limit
099	RESERVED			0	
100	PRESET POS	%	0	100	Valve position for DP ovrd
101	UPDATE TIM	SEC	0	10	Valve position update time
102	AFR LIMIT	ACF/H	1	0.0	Actual flow rate over- range limit 0.0=disabled
103	PRES SETPT	PSIG	0	100	Set Point for pres control
104	RESERVED			0	
105	ZFLOW LIM	SEC	0	15	Turbine zero flow cutoff time
106- 109	RESERVED			0	

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
110	CVM CHAN #	(None)	0	0	Selected channel to be monitored by the CVM function
111	CVM LO LMT	(None)	1	0.0	Low limit value
112	CVM HI LMT	(None)	1	5000.0	High limit value
113-128	RESERVED			0	
129	ZF 1	(None)	6	1.000000	Flowing compressibility
130-131	RESERVED			0	
132	FLW TIME 1	MIN	2	0.00	Flow time
133	FLOW RATE1	MCF/H	1	0.0	Hourly flow rate
134	FLOW RATE1	MCF/D	1	0.0	Daily flow rate
135	LOG VOL 1	MCF	1	0.0	Logged accumulated volume
136	TODAY VOL1	MCF	1	0.0	Daily accumulated volume
137	YSDAY VOL1	MCF	1	0.0	Ysday's accumulated volume
138	TOT VOL 1	MCF	1	0.0	Total accumulated volume (Rolls over @ 10,000,000)
139	ERATE 1	DTH/H	1	0.0	Energy flow rate
140	LOG ENRGY1	DTH	1	0.0	Logged accumulated energy
141	TDY ENRGY1	DTH	1	0.0	Today's accumulated energy
142	YSY ENRGY1	DTH	1	0.0	Ysday's accumulated energy
143	TOT ENRGY1	DTH	1	0.0	Total accumulated energy (Rolls over @ 10,000,000)

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
144	UNCR RATE1	ACF/H	1	0.0	Uncorrected flow rate
145	LOG UVOL1	ACF	1	0.0	Logged uncorrected volume
146	TDY UVOL1	ACF	1	0.0	Today's uncorrected volume
147	YSY UVOL1	ACF	1	0.0	Ysday's uncorrected volume
148	TOT UVOL1	ACF	1	0.0	Total uncorrected volume (Rolls over @ 10,000,000)
149	METR FCTR1	PPCF	2	100.00	Meter factor in pulses per actual cubit foot
150-158	RESERVED			0	
159	ZF 2	(None)	6	1.000000	Flowing compressibility
160-161	RESERVED			0	
162	FLW TIME 2	MIN	2	0.00	Flow time tube 2
163	FLOW RATE2	MCF/H	1	0.0	Hourly flow rate
164	FLOW RATE2	MCF/D	1	0.0	Daily flow rate
165	LOG VOL 2	MCF	1	0.0	Logged accumulated volume
166	TODAY VOL2	MCF	1	0.0	Today's accumulated volume
167	YSDAY VOL2	MCF	1	0.0	Ysday's accumulated volume
168	TOT VOL 2	MCF	1	0.0	Total accumulated volume (Rolls over @ 10,000,000)
169	ERATE 2	DTH/H	1	0.0	Energy flow rate

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
170	LOG ENRGY2	DTH	1	0.0	Logged accumulated energy
171	TDY ENRGY2	DTH	1	0.0	Today's accumulated energy
172	YSY ENRGY2	DTH	1	0.0	Ysday's accumulated energy
173	TOT ENRGY2	DTH	1	0.0	Total accumulated energy (Rolls over @ 10,000,000)
174	UNCR RATE2	ACF/H	1	0.0	Uncorrected flow rate
175	LOG UVOL2	ACF	1	0.0	Logged uncorrected volume
176	TDY UVOL2	ACF	1	0.0	Today's uncorrected volume
177	YSY UVOL2	ACF	1	0.0	Ysday's uncorrected volume
178	TOT UVOL2	ACF	1	0.0	Total uncorrected volume (Rolls over @ 10,000,000)
179	METR FCTR2	PPCF	2	100.00	Meter factor in pulses per actual cubit foot
180-209	RESERVED			0	
210	STN FLW RT	MCF/H	1	0.0	Flow rate per hour
211	STN FLW RT	MCF/D	1	0.0	Flow rate per day
212	ST LOG VOL	MCF	1	0.0	Station logged volume
213	ST TDY VOL	MCF	1	0.0	Station today's volume
214	YSDAY VOL	MCF	1	0.0	Station ysday's volume
215	ST TOT VOL	MCF	1	0.0	* Station total volume
216	STN ERATE	DTH/H	1	0.0	Station flow rate

CH	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
217	LOG ENERGY	DTH	1	0.0	Station logged energy
218	TDY ST ENG	DTH	1	0.0	Station today's energy
219	YSY ST ENG	DTH	1	0.0	Station ysdays energy
220	TOT ENERGY	DTH	1	0.0	* Station total energy
221	STN UNC RT	ACF/H	1	0.0	Station uncorrected flow rate
222	STN LOG UV	ACF	1	0.0	Station logged uncorrected volume
223	STN TDY UV	ACF	1	0.0	Station today's uncorrected volume
224	STN YSY UV	ACF	1	0.0	Station Ysday's uncorrected volume
225	STN TOT UV	ACF	1	0.0	*Station total uncorrected volume
226-240	RESERVED			0	

\* All totals roll over at 10,000,000 so adjust your units accordingly.

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### 3.0 SINGLE TURBINE/PD APPLICATION

Section 3 covers the individual requirements for the single turbine/PD application configured to calculate volume and flow rate using equations from paragraph 1.4. The single turbine/PD 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 specific gravity and BTU 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 paragraph 1.13. No changes should be required unless the previously used application has been significantly different.

The wiring configuration for the single turbine/PD 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.				
<i>or</i>				
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, temperature (to be installed by user)	Blue Black Red Gray	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	None, jumper pin 31 to 34	Black Black	31 34	Signal in + analog ground
23	None, jumper pin 35 to 38	Black Black	35 38	Signal in + Analog ground
24	EXTERNAL, LIVE SG <sup>(1) (2)</sup> (to be installed by user)		39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground
25	EXTERNAL, LIVE BTU <sup>(1) (2)</sup>		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	None, jumper pin 47 to 50	Black Black	47 50	Signal in + Analog ground



- 
- NOTES:**
- (1) Since fixed values are normally desired for BTU and SG, digital input channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 51 and 60, 52 and 61 on the rear termination board. The fixed values for BTU 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.
-

**3.2 STATUS SIGNAL CONNECTIONS**

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

**3.2.1 INPUTS**

<b>CH</b>	<b>SIGNAL DESCRIPTION</b>	<b>LABEL</b>	<b>TB1 PIN NO.</b>	<b>SIGNAL TYPE</b>
1	Live or fixed SG	LIVE SG	60 51 (GND)	Open, means use LIVE SG Shorted, means use FIXED SG
2	Live or fixed BTU	LIVE BTU	61 52 (GND)	Open, means use LIVE BTU Shorted, means use FIXED BTU
18	Chromatograph option	CHROM	68 59 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

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

Note that serial chromatograph inputs require that SG and BTU 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 CONFIG submenu of the SETUP UNIT menu.

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 69	TTL output Common
6	Volume pulse output 2	VP2	79 70	TTL output Common
13	Channel Value Monitor	CVM STATUS	84 75	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 2251 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 Systems Reference Manual.

MODEL 2251	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out	102	DI in
Serial in	103	DI out
Ground	106	DI ground

### 3.2.5 TURBINE/PD INPUT CONNECTIONS

Refer to Drawing DE-11330, sheet 3 for information regarding wiring detail. The applicable ports are "PD #1" or "TURBIN #1" for meter number one and "PD #2" and "TURBIN #2" for meter number two.

**3.3 SETUP LOCATION MENU**

The SolarFlow Plus operating parameters for the enhanced single 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 paragraph 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 <sup>(1)</sup>	120	_____
USER REP <sup>(2)</sup>	****	_____
PCOMM RATE <sup>(3)</sup>	1200 BPS	_____
RTS DELAY <sup>(4)</sup>	0 1/100s	_____

- 
- NOTES:**
- (1) Refer to paragraph 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.
  - (2) Refer to paragraph 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt.
  - (3) Refer to paragraph 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.
  - (4) Refer to paragraph 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 enhanced single turbine/PD 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 <sup>(1)</sup>		_____
RESET CMOD <sup>(2)</sup>	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 paragraph 1.9 for a description of the LOG DEFINE prompt.
  - (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 paragraph 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 enhanced single turbine/PD 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.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>
METR PRES	0.0 PSIG
FLOW TEMP	0.0 DEG F
LIVE SG	0.000
LIVE BTU	0.0
BATTERY	0.0 VOLTS
AUX ANLG 4	0.0 %
AUX ANLG 5	0.0 %
AUX ANLG 8	0.0 %
FLW RT OUT	0.0 MCFH
VALVE POS	50.0 %

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 paragraph 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>		<b>DESIRED</b>
M PRES/LO	0	PSIG	_____
M PRES/HI	1000	PSIG	_____
M TEMP/LO	0.0	DEG F	_____
M TEMP/HI	150.0	DEG F	_____
LIVE SG/LO	0.5		_____
LIVE SG/HI	1.0		_____
BTU/LO	800		_____
BTU/HI	1200		_____
FLW RT LOW	0.0	MCFH	_____
FLW RT HI	5000.0	MCFH	_____
VLV POS LO	0.0	%	_____
VLV POS HI	100.0	%	_____
AUX 4 LO	0	%	_____
AUX 4 HI	100	%	_____
AUX 5 LO	0	%	_____
AUX 5 HI	100	%	_____
AUX 8 LO	0	%	_____
AUX 8 HI	100	%	_____



3.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
CVM STATUS	OFF
OUTPUT 14	OFF
OUTPUT 15	OFF

3.4.5 CONFIG SUBMENU

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

HHDT PROMPT	SAMPLE VALUES		DESIRED
METR FCTR1	100.00	PPCF	_____
ZFLOW LIM	15	SEC	_____
ATMS PRES	14.73	PSIA	_____
PRES BASE	14.73	PSIA	_____
TEMP BASE	60	DEG F	_____
AGA8 MTHD	0		_____
SG SELECT	0		_____
CHROM ADDR	1		_____
CHROM STRM	1		_____
VERSION	1.0		_____

## 3.4.6 GAS DATA

This enhanced SolarFlow Plus software can accept information from the Model 2251 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 58 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 paragraph 1.5.

<b>HHDT PROMPT</b>	<b>SAMPLE VALUES</b>		<b>DESIRED</b>
SPEC GRAV	0.6000		_____
BTU	1000.0		_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
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 paragraph 1.7 for more information.

HHDT PROMPT	SAMPLE VALUES		DESIRED
VPP1	100.0	MCF	_____
PP1	1.0	SEC	_____
VPP2	100.0	MCF	_____
PP2	1.0	SEC	_____
CVM CHAN #	0		_____
CVM LO LMT	0.0		_____
CVM HI LMT	5000.0		_____
VP MODE	0		_____
FLW SETPNT	0.0	MCFH	_____
PRES SETPT	100	PSIG	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5.0	%	_____
PRES CHAN#	20		_____
OVRD PRES	0	PSIG	_____
AFR LIMIT	5000.0	ACF/H	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALV 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.

<b>HHDT PROMPT</b>	<b>SAMPLE VALUES</b>		<b>DESIRED</b>
FLOW RATE1	0.0	MCFH	_____
UNCR RATE1	0.0	ACF/H	_____
AGA8 MTHD	1		_____
ZB	1.038190		_____
ZF 1	0.927767		_____
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, CALC DATA and RATE/VOLS.

#### 3.5.1 ANALOGS

METR PRES  
FLOW TEMP  
LIVE SG  
LIVE BTU  
BATTERY  
AUX ANLG 4  
AUX ANLG 5  
AUX ANLG 8  
FLW RT OUT  
VALV POS

#### 3.5.2 SCALES

M PRES/LO	AUX5 LO
M PRES/HI	AUX5 HI
M TEMP/LO	AUX8 LO
M TEMP/HI	AUX8 HI
LIVE SG/LO	
LIVE SG/HI	
BTU/LO	
BTU/HI	
FLW RT LOW	
FLW RT HI	
VLV POS LO	
VLV POS HI	
AUX4 LO	
AUX4 HI	

### 3.5.3 DISCRETES

LIVE GRAV  
LIVE BTU  
CHROM  
VP 1  
VP 2  
CVM STATUS  
INPUT 3  
INPUT 4  
INPUT 9  
INPUT 10  
INPUT 16  
INPUT 17

### 3.5.4 CONFIG

METR FCTR1  
ZFLOW LIM  
ATMS PRES  
PRES BASE  
TEMP BASE  
AGA8 MTHD  
SG SELECT  
CHROM ADDR  
CHROM STRM  
VERSION

3.5.5 GAS DATA

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

**3.5.6 CONTROL**

VPP 1  
PP1  
VPP 2  
PP 2  
CVM CHAN #  
CVM LO LMT  
CVM HI LMT  
VP MODE  
FLW SETPNT  
PRES SETPT  
DEADBAND  
SMALL STEP  
LARGE STEP  
FINE CNTRL  
PRES CHAN#  
OVRD PRESS  
AFR LIMIT  
PRESET POS  
UPDATE TIM  
VALVE POS



3.5.7 CALC DATA

FLOW RATE1  
UNCR RATE1  
AGA8 MTHD  
ZB  
ZF 1  
B - AGA8  
C - AGA8  
D - AGA8  
K - AGA8  
MOL WT.

3.5.8 RATE/VOLS

FLOW RATE1 (MCFH)  
FLOW RATE1 (MCFD)  
TODAY VOL1  
YSDAY VOL1  
TOT VOL 1  
UNCR RATE1  
TDY UVOL 1  
YSY UVOL 1  
TOT UVOL 1  
ERATE 1  
TDY ENRGY1  
YSY ENRGY1  
TOT ENRGY1

### **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 paragraph 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

#### **3.6.1 PRESSURE**

The PRESSURE selection of the CALIBRATE UNIT menu provides for calibrating the pressure input listed as follows:

METR PRES

#### **3.6.2 TEMPERATURE**

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

#### **3.6.3 OTHERS**

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

LIVE SG  
LIVE BTU  
AUX ANLG 4  
AUX ANLG 5  
AUX ANLG 8

**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. Refer to paragraph 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

- METR PRES
- FLOW TEMP
- LIVE SG
- LIVE BTU
- AUX ANLG 4
- AUX ANLG 5
- AUX ANLG 8

**3.8 USER REPORT (CHANNEL 0)**

The User Report (Channel 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 Report on the front panel in a scrolling format.

CHANNEL NUMBER	CHANNEL LABEL	DESCRIPTION
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in PSIG
021	FLOW TEMP1	Live temperature in degrees Fahrenheit (°F)
024	LIVE SG	Live value for specific gravity
144	UNCR RATE1	Uncorrected flow rate
133	FLOW RATE1	Hourly flow rate for meter No.1
138	TOT VOL 1	Total accumulated volume for meter No. 1
148	TOT UVOL 1	Total uncorrected volume for meter No. 1
136	TODAY VOL1	Daily accumulated volume
137	YSDAY VOL1	Yesterday's accumulated volume

**3.9 DATA LOG LIST CONTENTS**

The following items are included on the data log. The data log is set to a 1-hour log interval. The default contract hour is 7:00 am.

<b>CHANNEL NUMBER</b>	<b>CHANNEL LABEL</b>	<b>DECIMAL PLACES</b>	<b>DIGITS</b>	<b>LOGGING TYPE</b>
020	METR PRES	1	6	AVERAGE
021	FLOW TEMP	1	4	AVERAGE
132	FLW TIME	1	6	SNAPSHOT & ZERO
145	LOG UVOL 1	1	6	SNAPSHOT & ZERO
135	LOG VOL	1	6	SNAPSHOT & ZERO

**3.10 DATA LOG HEADER BLOCK CONTENTS**

The data log header block includes the following items:

M PRES/LO  
M PRES/HI  
M TEMP/LO  
M TEMP/HI  
LIVE SG/LO  
LIVE SG/HI  
BTU LO  
BTU HI  
METR FCTR1  
ZFLOW LIM  
ATMS PRES  
PRES BASE  
TEMP BASE  
AGA8 MTHD  
SG SELECT

(Continued on the next page)

Header Block Contents (Continued)

SPEC GRAV  
BTU  
CO2  
N2  
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, 11-12, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	$C(19) < X$	BATTERY LO	16.0	10.8	0.0	0
2	$C(20) < X * S(20,F)$ or $C(20) > Y * S(20,F)$	METR PRES1	1000	0.0	1.01	0
3	$C(21) < X * S(21,F)$ or $C(21) > Y * S(21,F)$	FLOW TEMP1	150.0	0.0	1.01	0
4*	$C(22) < X * S(22,F)$ or $C(22) > Y * S(22,F)$	AUX ANLG 4	-	0.0	1.01	0
5*	$C(23) < X * S(23,F)$ or $C(23) > Y * S(23,F)$	AUX ANLG 5	-	0.0	1.01	0
6*	$C(24) < X * S(24,F)$ or $C(24) > Y * S(24,F)$	LIVE SG	1.0	0.0	1.01	0
7*	$C(25) < X * S(25,F)$ or $C(25) > Y * S(25,F)$	LIVE BTU	1200	0.0	1.01	0
8*	$C(26) < X * S(26,F)$ or $C(26) > Y * S(26,F)$	AUX ANLG 8	100	0.0	1.01	0

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	999999.0	0
10	C(30) <> 0.0	SYS ERROR		0.0	0.0	0
11	C(144) < X or C(144) > Y	UNCR RATE1	-	0.0	999999.0	0
12	C(174) < X or C(174) > Y	UNCR RATE2	-	0.0	999999.0	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 = 1000 PSIG

Therefore, the alarm set point for alarm #2 is 1.01(1000) = 1010 PSIG.

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.



## 4.0 DUAL TURBINE/PD APPLICATION (2P2T)

Section 4 covers the individual requirements for the dual turbine/PD application configured to calculate volume and flow rate using equations from paragraph 1.4. The dual turbine/PD application supports measurement on two meter tubes with separate pressure and temperature 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 specific gravity and BTU 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 paragraph 1.13. No changes should be required unless the previously used application has been significantly different.

The wiring configuration for the dual turbine/PD 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.				
<i>or</i>				
20	EXTERNAL, static pressure for meter 1 (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, meter 1 temperature (to be installed by user)	Blue Black Red Gray	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	EXTERNAL, static pressure for meter 2 (to be installed by user)		31 34 33 32	Signal in + Analog ground 8 to 10 VDC Earth ground
23	EXTERNAL, meter 2 temperature (to be installed by user)		35 38 37 36	Signal in + Analog ground 8 to 10 VDC Earth ground
24	EXTERNAL, LIVE SG <sup>(1) (2)</sup> (to be installed by user)		39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground
25	EXTERNAL, LIVE BTU <sup>(1) (2)</sup>		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	None, jumper pin 47 to 50	Black Black	47 50	Signal in + Analog ground

- NOTES:**
- (1) Since fixed values are normally desired for BTU and SG, digital input channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 51 and 60, 52 and 61 on the rear termination board. The fixed values for BTU 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.
-

**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**

<b>CH</b>	<b>SIGNAL DESCRIPTION</b>	<b>LABEL</b>	<b>TB1 PIN NO.</b>	<b>SIGNAL TYPE</b>
1	Live or fixed SG	LIVE SG	60 51 (GND)	Open, means use LIVE SG Shorted, means use FIXED SG
2	Live or fixed BTU	LIVE BTU	61 52 (GND)	Open, means use LIVE BTU Shorted, means use FIXED BTU
18	Chromatograph option	CHROM	68 59 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

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

Note that serial chromatograph inputs require that SG and BTU 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 CONFIG submenu of the SETUP UNIT menu.

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, 6, 7, and 8 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 69	TTL Output Common
6	Volume pulse output 2	VP2	79 70	TTL Output Common
7	Valve control open	OPEN 2	80 71	TTL Output Common
8	Valve control close	CLOSE 2	81 72	TTL Output Common
13	Channel Value Monitor	CVM STATUS	84 75	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 2251 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 Systems Reference Manual.

MODEL 2251	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out	102	DI in
Serial in	103	DI out
Ground	106	DI ground

## 4.2.5 TURBINE/PD INPUT CONNECTIONS

Refer to Drawing DE-11330, sheet 3 for information regarding wiring detail. The applicable ports are "PD #1" or "TURBIN #1" for meter number one and "PD #2" and "TURBIN #2" for meter number two.

**4.3 SETUP LOCATION MENU**

The SolarFlow Plus operating parameters for the enhanced dual turbine/PD 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 paragraph 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 <sup>(1)</sup>	120	_____
USER REP <sup>(2)</sup>	****	_____
PCOMM RATE <sup>(3)</sup>	1200 BPS	_____
RTS DELAY <sup>(4)</sup>	0 1/100s	_____

- 
- NOTES:**
- (1) Refer to paragraph 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.
  - (2) Refer to paragraph 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt.
  - (3) Refer to paragraph 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.
  - (4) Refer to paragraph 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 enhanced single turbine/PD 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 <sup>(1)</sup>		_____
RESET CMOD <sup>(2)</sup>	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 paragraph 1.9 for a description of the LOG DEFINE prompt.
  - (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 paragraph 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 the enhanced dual turbine/PD 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.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>
METR PRES1	0.0 PSIG
FLOW TEMP1	0.0 DEG F
METR PRES2	0.0 PSIG
FLOW TEMP2	0.0 DEG F
LIVE SG	0.000
LIVE BTU	0.0
BATTERY	0.0 VOLTS
AUX ANLG 8	0.0 %
FLW RT OUT	0.0 MCFH
VALVE POS	50.0 %

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 paragraph 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>		<b>DESIRED</b>
M PRES1/LO	0	PSIG	_____
M PRES1/HI	1000	PSIG	_____
M TEMP1/LO	0.0	DEG F	_____
M TEMP1/HI	150.0	DEG F	_____
M PRES2/LO	0	PSIG	_____
M PRES2/HI	1000	PSIG	_____
M TEMP2/LO	0	DEG F	_____
M TEMP2/HI	150.0	DEG F	_____
LIVE SG/LO	0.5		_____
LIVE SG/HI	1.0		_____
BTU/LO	800		_____
BTU/HI	1200		_____
FLW RT LOW	0.0	MCFH	_____
FLW RT HI	5000.0	MCFH	_____
VLV POS LO	0.0	%	_____
VLV POS HI	100.0	%	_____
AUX 8 LO	0	%	_____
AUX 8 HI	100	%	_____

4.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
OPEN 2	OFF
CLOSE 2	OFF
CVM STATUS	OFF
OUTPUT 14	OFF
OUTPUT 15	OFF

4.4.5 CONFIG SUBMENU

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

HHDT PROMPT	SAMPLE VALUES		DESIRED
METR FCTR1	100.00	PPCF	_____
METR FCTR2	100.00	PPCF	_____
ZFLOW LIM	15	SEC	_____
ATMS PRES	14.73	PSIA	_____
PRES BASE	14.73	PSIA	_____
TEMP BASE	60	DEG F	_____
AGA8 MTHD	0		_____
SG SELECT	0		_____
CHROM ADDR	1		_____
CHROM STRM	1		_____
VERSION	1.0		_____

## 4.4.6 GAS DATA

This enhanced SolarFlow Plus software can accept information from the Model 2251 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 58 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 paragraph 1.5.

<b>HHDT PROMPT</b>	<b>SAMPLE VALUES</b>		<b>DESIRED</b>
SPEC GRAV	0.6000		_____
BTU	1000.0		_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
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 for the volume pulse outputs and valve positioning. Refer to paragraph 1.7 for more information.

HHDT PROMPT	SAMPLE VALUES		DESIRED
VPP1	100.0	MCF	_____
PP1	1.0	SEC	_____
VPP2	100.0	MCF	_____
PP2	1.0	SEC	_____
CVM CHAN #	0		_____
CVM LO LMT	0.0		_____
CVM HI LMT	5000.0		_____
TS ENABLE	0		_____
OPEN 2 SP	1000.0	ACF/H	_____
CLOSE 2 SP	4000.0	ACF/H	_____
TS DELAY	30	SECS	_____
TS VLV TIM	30	SECS	_____
VP MODE	0		_____
FLW SETPNT	0.0	MCFH	_____
PRES SETPT	100	PSIG	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5.0	%	_____
PRES CHAN#	20		_____
OVRD PRES	0	PSIG	_____
AFR LIMIT	5000.0	ACF/H	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALV 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.

<b>HHDT PROMPT</b>	<b>SAMPLE VALUES</b>	<b>DESIRED</b>
AGA8 MTHD	1	_____
ZB	1.038190	_____
FLOW RATE1	0.0 MCFH	_____
UNCR RATE1	0.0 ACF/H	_____
ZF 1	0.927767	_____
FLOW RATE2	0.0 MCFH	_____
UNCR RATE2	0.0 ACF/H	_____
ZF 2	0.927767	_____
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, CALC DATA and RATE/VOLS.

### 4.5.1 ANALOGS

METR PRES1  
FLOW TEMP1  
METR PRES2  
FLOW TEMP2  
LIVE SG  
LIVE BTU  
BATTERY  
AUX ANLG 8  
FLW RT OUT  
VALV POS

### 4.5.2 SCALES

M PRES1/LO	AUX8 LO
M PRES1/HI	AUX8 HI
M TEMP1/LO	
M TEMP1/HI	
M PRES2/LO	
M PRES2/HI	
M TEMP2/LO	
M TEMP2/HI	
LIVE SG/LO	
LIVE SG/HI	
BTU/LO	
BTU/HI	
FLW RT LOW	
FLW RT HI	
VLV POS LO	
VLV POS HI	

#### 4.5.3 DISCRETES

LIVE GRAV  
SG  
LIVE BTU  
CHROM  
VP 1  
VP 2  
CVM STATUS  
OPEN 2  
CLOSE 2  
INPUT 3  
INPUT 4  
INPUT 9  
INPUT 10  
INPUT 16  
INPUT 17

#### 4.5.4 CONFIG

METR FCTR1  
METR FCTR2  
ZFLOW LIM  
ATMS PRES  
PRES BASE  
TEMP BASE  
AGA8 MTHD  
SG SELECT  
CHROM ADDR  
CHROM STRM  
VERSION



4.5.5 GAS DATA

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

## 4.5.6 CONTROL

VPP 1  
PP1  
VPP 2  
PP 2  
CVM CHAN #  
CVM LO LMT  
CVM HI LMT  
TS ENABLE  
OPEN 2 SP  
CLOSE 2 SP  
TS DELAY  
TS VLV TIM  
VP MODE  
FLW SETPNT  
PRES SETPT  
DEADBAND  
SMALL STEP  
LARGE STEP  
FINE CNTRL  
PRES CHAN#  
OVRD PRESS  
AFR LIMIT  
PRESET POS  
UPDATE TIM  
VALVE POS

## 4.5.7 CALC DATA

AGA8 MTHD	D - AGA8
ZB	K - AGA8
FLOW RATE1	MOL WT.
UNCR RATE1	
ZF 1	
FLOW RATE2	
UNCR RATE2	
ZF 2	
B - AGA8	
C - AGA8	

4.5.8 RATE/VOLS

FLOW RATE1 (MCFH)	TDY ENERGY
FLOW RATE1 (MCFD)	YSY ENERGY
TODAY VOL1	TOT ENERGY
YSDAY VOL1	
TOT VOL 1	
FLOW RATE2 (MCFH)	
FLOW RATE2 (MCFD)	
TODAY VOL2	
YSDAY VOL2	
TOT VOL 2	
STN FLW RT (MCFH)	
STN FLW RT (MCFD)	
ST TDY VOL	
ST YSY VOL	
ST TOT VOL	
UNCR RATE1	
TDY UVOL 1	
YSY UVOL 1	
TOT UVOL 1	
UNCR RATE2	
TDY UVOL 2	
YSY UVOL 2	
TOT UVOL 2	
STN UNC RT	
ST TDY UV	
ST YSY UV	
ST TOT UV	
ERATE 1	
TDY ENRGY1	
YSY ENRGY1	
TOT ENRGY1	
ERATE 2	
TDY ENRGY2	
YSY ENRGY2	
TOT ENRGY2	
STN ERATE	

## **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 paragraph 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

### **4.6.1 PRESSURES**

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

METR PRES1  
METR PRES2

### **4.6.2 TEMPERATURES**

The TEMP selection of the CALIBRATE UNIT menu provides for calibrating the temperatures as follows:

FLOW TEMP1  
FLOW TEMP2

### **4.6.3 OTHERS**

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

LIVE SG  
LIVE BTU  
AUX ANLG 8

#### **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. Refer to paragraph 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES1  
FLOW TEMP1  
METR PRES2  
FLOW TEMP2  
LIVE SG  
LIVE BTU  
AUX ANLG 8

**4.8 USER REPORT (CHANNEL 0)**

The User Report (Channel 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 Report on the front panel in a scrolling format.

<b>CHANNEL NUMBER</b>	<b>CHANNEL LABEL</b>	<b>DESCRIPTION</b>
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in PSIG
021	FLOW TEMP1	Live temperature in degrees Fahrenheit (°F)
022	METR PRES2	Live pressure meter No.2 in PSIG
023	FLOW TEMP2	Live temperature in degrees Fahrenheit (°F)
024	LIVE SG	Live value for specific gravity
144	UNCR RATE1	Uncorrected flow rate, meter No.1
133	FLOW RATE1	Hourly flow rate for meter No.1
138	TOT VOL 1	Total accumulated volume for meter No. 1
148	TOT UVOL 1	Total uncorrected volume for meter No. 1
174	UNCR RATE2	Uncorrected flow rate, meter No.2
163	FLOW RATE2	Hourly flow rate for meter No.2
168	TOT VOL 2	Total accumulated volume for meter No.2
178	TOT UVOL2	Total uncorrected 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 items are included on the data log. 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
020	METR PRES1	1	6	AVERAGE
021	FLOW TEMP1	1	4	AVERAGE
132	FLW TIME 1	1	6	SNAPSHOT & ZERO
145	LOG UVOL 1	1	6	SNAPSHOT & ZERO
135	LOG VOL 1	1	6	SNAPSHOT & ZERO
022	METR PRES2	1	6	AVERAGE
023	FLOW TEMP2	1	4	AVERAGE
162	FLW TIME 2	1	6	SNAPSHOT & ZERO
175	LOG UVOL 2	1	6	SNAPSHOT & ZERO
165	LOG VOL 2	1	6	SNAPSHOT & ZERO

**4.10 DATA LOG HEADER BLOCK CONTENTS**

The data log header block includes the following items:

- M PRES1/LO
- M PRES1/HI
- M TEMP1/LO
- M TEMP1/HI
- M PRES2/LO
- M PRES2/HI
- M TEMP2/LO
- M TEMP2/HI
- LIVE SG/LO
- LIVE SG/HI
- BTU LO
- BTU HI
- METR FCTR1
- METR FCTR2

(Continued on the next page)

## Header Block Contents (Continued)

ZFLOW LIM  
ATMS PRES  
PRES BASE  
TEMP BASE  
AGA8 MTHD  
SG SELECT  
SPEC GRAV  
BTU  
CO2  
N2  
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, 11-12, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	C(19) < X	BATTERY LO	16.0	10.8	0.0	0
2	C(20) < X*S(20,F) or C(20) > Y*S(20,F)	METR PRES1	1000	0.0	1.01	0
3	C(21) < X*S(21,F) or C(21) > Y*S(21,F)	FLOW TEMP1	150.0	0.0	1.01	0
4	C(22) < X*S(22,F) or C(22) > Y*S(22,F)	METR PRES2	1000	0.0	1.01	0
5	C(23) < X*S(23,F) or C(23) > Y*S(23,F)	FLOW TEMP2	150.0 -	0.0	1.01	0
6*	C(24) < X*S(24,F) or C(24) > Y*S(24,F)	LIVE SG	1.0	0.0	1.01	0
7*	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	LIVE BTU	1200	0.0	1.01	0
8*	C(26) < X*S(26,F) or C(26) > Y*S(26,F)	AUX ANLG 8	100	0.0	1.01	0

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	999999.0	0
10	C(30) <> 0.0	SYS ERROR		0.0	0.0	0
11	C(144) < X or C(144) > Y	UNCR RATE1	-	0.0	999999.0	0
12	C(174) < X or C(174) > Y	UNCR RATE2	-	0.0	999999.0	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.

$$F = 1000 \text{ PSIG}$$

Therefore, the alarm set point for alarm #2 is  $1.01(1000) = 1010 \text{ PSIG}$ .

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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## 5.0 DUAL TURBINE/PD APPLICATION (2P1T)

Section 5 covers the individual requirements for the dual turbine/PD application with common temperature configured to calculate volume and flow rate using equations from paragraph 1.4. The dual turbine/PD application supports measurement on two meter tubes with separate pressure and one common temperature 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 specific gravity and BTU 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 paragraph 1.13. No changes should be required unless the previously used application has been significantly different.

The wiring configuration for the dual turbine/PD analog inputs with a common temperature input 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.				
<i>or</i>				
20	EXTERNAL, static pressure for meter 1 (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, meter 1 temperature (to be installed by user)	Blue Black Red Gray	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	EXTERNAL, static pressure for meter 2 (to be installed by user)		31 34 33 32	Signal in + Analog ground 8 to 10 VDC Earth ground
23	None, jumper pin 35 to 38		35 38	Signal in + Analog ground
24	EXTERNAL, LIVE SG <sup>(1) (2)</sup> (to be installed by user)		39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground
25	EXTERNAL, LIVE BTU <sup>(1) (2)</sup>		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	None, jumper pin 47 to 50	Black Black	47 50	Signal in + Analog ground

- NOTES:**
- (1) Since fixed values are normally desired for BTU and SG, digital input channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 51 and 60, 52 and 61 on the rear termination board. The fixed values for BTU 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.
-

## 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 SG	LIVE SG	60 51 (GND)	Open, means use LIVE SG Shorted, means use FIXED SG
2	Live or fixed BTU	LIVE BTU	61 52 (GND)	Open, means use LIVE BTU Shorted, means use FIXED BTU
18	Chromatograph option	CHROM	68 59 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

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

Note that serial chromatograph inputs require that SG and BTU 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 CONFIG submenu of the SETUP UNIT menu.

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, 6, 7 and 8 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 69	TTL Output Common
6	Volume pulse output 2	VP2	79 70	TTL Output Common
7	Valve control open	OPEN 2	80 71	TTL Output Common
8	Valve control close	CLOSE 2	81 72	TTL Output Common
13	Channel Value Monitor	CVM STATUS	84 75	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 2251 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 Systems Reference Manual.

MODEL 2251	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out	102	DI in
Serial in	103	DI out
Ground	106	DI ground

## 5.2.5 TURBINE/PD INPUT CONNECTIONS

Refer to Drawing DE-11330, sheet 3 for information regarding wiring detail. The applicable ports are "PD #1" or "TURBIN #1" for meter number one and "PD #2" and "TURBIN #2" for meter number two.

**5.3 SETUP LOCATION MENU**

The SolarFlow Plus operating parameters for the enhanced dual turbine/PD application (with common temperature input) 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 paragraph 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 <sup>(1)</sup>	120	_____
USER REP <sup>(2)</sup>	****	_____
PCOMM RATE <sup>(3)</sup>	1200 BPS	_____
RTS DELAY <sup>(4)</sup>	0 1/100s	_____

- 
- NOTES:**
- (1) Refer to paragraph 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.
  - (2) Refer to paragraph 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt.
  - (3) Refer to paragraph 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.
  - (4) Refer to paragraph 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 enhanced single turbine/PD application (with common temperature input) 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.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>	<b>DESIRED</b>
UNIT NAME	BLANK UNIT	_____
UNIT ID	BLANK-ID	_____
CONTRCT HR	7 (0-23)	_____
LOG INTRVL	1 HOUR	_____
LOG DEFINE <sup>(1)</sup>		_____
RESET CMOD <sup>(2)</sup>	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 paragraph 1.9 for a description of the LOG DEFINE prompt.
  - (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 paragraph 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 of the enhanced dual turbine/PD application (with common temperature input) 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.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>
METR PRES1	0.0 PSIG
FLOW TEMP1	0.0 DEG F
METR PRES2	0.0 PSIG
LIVE SG	0.000
LIVE BTU	0.0
BATTERY	0.0 VOLTS
AUX ANLG 5	0.0 %
AUX ANLG 8	0.0 %
FLW RT OUT	0.0 MCFH
VALVE POS	50.0 %

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 paragraph 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>		<b>DESIRED</b>
M PRES1/LO	0	PSIG	_____
M PRES1/HI	1000	PSIG	_____
M TEMP1/LO	0.0	DEG F	_____
M TEMP1/HI	150.0	DEG F	_____
M PRES2/LO	0	PSIG	_____
M PRES2/HI	1000	PSIG	_____
LIVE SG/LO	0.5		_____
LIVE SG/HI	1.0		_____
BTU/LO	800		_____
BTU/HI	1200		_____
FLW RT LOW	0.0	MCFH	_____
FLW RT HI	5000.0	MCFH	_____
VLV POS LO	0.0	%	_____
VLV POS HI	100.0	%	_____
AUX 5 LO	0	%	_____
AUX 5 HI	100	%	_____
AUX 8 LO	0	%	_____
AUX 8 HI	100	%	_____

5.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
OPEN 2	OFF
CLOSE 2	OFF
CVM STATUS	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 paragraph 5.10.2.4 in the Model 2470 System Reference Manual for additional information about the CONFIG submenu.

HHDT PROMPT	SAMPLE VALUES		DESIRED
METR FCTR1	100.00	PPCF	_____
METR FCTR2	100.00	PPCF	_____
ZFLOW LIM	15	SEC	_____
ATMS PRES	14.73	PSIA	_____
PRES BASE	14.73	PSIA	_____
TEMP BASE	60	DEG F	_____
AGA8 MTHD	0		_____
SG SELECT	0		_____
CHROM ADDR	1		_____
CHROM STRM	1		_____
VERSION	1.0		_____

## 5.4.6 GAS DATA

This enhanced SolarFlow Plus software can accept information from the Model 2251 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 58 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 paragraph 1.5.

<b>HHDT PROMPT</b>	<b>SAMPLE VALUES</b>		<b>DESIRED</b>
SPEC GRAV	0.6000		_____
BTU	1000.0		_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
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 for the volume pulse outputs and valve positioning. Refer to paragraph 1.7 for more information.

HHDT PROMPT	SAMPLE VALUES		DESIRED
VPP1	100.0	MCF	_____
PP1	1.0	SEC	_____
VPP2	100.0	MCF	_____
PP2	1.0	SEC	_____
CVM CHAN #	0		_____
CVM LO LMT	0.0		_____
CVM HI LMT	5000.0		_____
TS ENABLE	0		_____
OPEN 2 SP	1000.0	ACF/H	_____
CLOSE 2 SP	4000.0	ACF/H	_____
TS DELAY	30	SECS	_____
TS VLV TIM	30	SECS	_____
VP MODE	0		_____
FLW SETPNT	0.0	MCFH	_____
PRES SETPT	100	PSIG	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5.0	%	_____
PRES CHAN#	20		_____
OVRD PRES	0	PSIG	_____
AFR LIMIT	5000.0	ACF/H	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALV 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.

<b>HHDT PROMPT</b>	<b>SAMPLE VALUES</b>	<b>DESIRED</b>
AGA8 MTHD	1	_____
ZB	1.038190	_____
FLOW RATE1	0.0 MCFH	_____
UNCR RATE1	0.0 ACF/H	_____
ZF 1	0.927767	_____
FLOW RATE2	0.0 MCFH	_____
UNCR RATE2	0.0 ACF/H	_____
ZF 2	0.927767	_____
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, CALC DATA and RATE/VOLS.

### 5.5.1 ANALOGS

METR PRES1  
FLOW TEMP1  
METR PRES2  
LIVE SG  
LIVE BTU  
BATTERY  
AUX ANLG 5  
AUX ANLG 8  
FLW RT OUT  
VALV POS

### 5.5.2 SCALES

M PRES1/LO	AUX8 LO
M PRES1/HI	AUX8 HI
M TEMP1/LO	
M TEMP1/HI	
METR PRES2/LO	
METR PRES2/HI	
LIVE SG/LO	
LIVE SG/HI	
BTU/LO	
BTU/HI	
FLW RT LOW	
FLW RT HI	
VLV POS LO	
VLV POS HI	
AUX 5 LO	
AUX 5 HI	

### 5.5.3 DISCRETES

LIVE GRAV  
SG  
LIVE BTU  
CHROM  
VP 1  
VP 2  
CVM STATUS  
OPEN 2  
CLOSE 2  
INPUT 3  
INPUT 4  
INPUT 9  
INPUT 10  
INPUT 16  
INPUT 17

### 5.5.4 CONFIG

METR FCTR1  
METR FCTR2  
ZFLOW LIM  
ATMS PRES  
PRES BASE  
TEMP BASE  
AGA8 MTHD  
SG SELECT  
CHROM ADDR  
CHROM STRM  
VERSION

5.5.5 GAS DATA

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

5.5.6 CONTROL

VPP 1  
PP1  
VPP 2  
PP 2  
CVM CHAN #  
CVM LO LMT  
CVM HI LMT  
TS ENABLE  
OPEN 2 SP  
CLOSE 2 SP  
TS DELAY  
TS VLV TIM

VP MODE  
FLW SETPNT  
PRES SETPT  
DEADBAND  
SMALL STEP  
LARGE STEP  
FINE CNTRL  
PRES CHAN#  
OVRD PRESS  
AFR LIMIT  
PRESET POS  
UPDATE TIM  
VALVE POS

#### 5.5.7 CALC DATA

AGA8 MTHD  
ZB  
FLOW RATE1  
UNCR RATE1  
ZF 1  
FLOW RATE2  
UNCR RATE2  
ZF 2  
B - AGA8  
C - AGA8  
D - AGA8  
K - AGA8  
MOL WT.

5.5.8 RATE/VOLS

FLOW RATE1 (MCFH)	TDY ENERGY
FLOW RATE1 (MCFD)	YSY ENERGY
TODAY VOL1	TOT ENERGY
YSDAY VOL1	
TOT VOL 1	
FLOW RATE2 (MCFH)	
FLOW RATE2 (MCFD)	
TODAY VOL2	
YSDAY VOL2	
TOT VOL 2	
STN FLW RT (MCFH)	
STN FLW RT (MCFD)	
ST TDY VOL	
ST YSY VOL	
ST TOT VOL	
UNCR RATE1	
TDY UVOL 1	
YSY UVOL 1	
TOT UVOL 1	
UNCR RATE2	
TDY UVOL 2	
YSY UVOL 2	
TOT UVOL 2	
STN UNC RT	
ST TDY UV	
ST YSY UV	
ST TOT UV	
ERATE 1	
TDY ENRGY1	
YSY ENRGY1	
TOT ENRGY1	
ERATE 2	
TDY ENRGY2	
YSY ENRGY2	
TOT ENRGY2	
STN ERATE	

## **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 paragraph 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

### **5.6.1 PRESSURES**

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

METR PRES1  
METR PRES2

### **5.6.2 TEMPERATURES**

The TEMP selection of the CALIBRATE UNIT menu provides for calibrating the temperature as follows:

FLOW TEMP1

### **5.6.3 OTHERS**

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

LIVE SG  
LIVE BTU  
AUX ANLG 5  
AUX ANLG 8



## **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. Refer to paragraph 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES1  
FLOW TEMP1  
METR PRES2  
LIVE SG  
LIVE BTU  
AUX ANLG 5  
AUX ANLG 8

**5.8 USER REPORT (CHANNEL 0)**

The User Report (Channel 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 Report on the front panel in a scrolling format.

<b>CHANNEL NUMBER</b>	<b>CHANNEL LABEL</b>	<b>DESCRIPTION</b>
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in PSIG
021	FLOW TEMP1	Live temperature in degrees Fahrenheit (°F)
022	METR PRES2	Live pressure meter No.2 in PSIG
024	LIVE SG	Live value for specific gravity
144	UNCR RATE1	Uncorrected flow rate, meter No.1
133	FLOW RATE1	Hourly flow rate for meter No.1
138	TOT VOL 1	Total accumulated volume for meter No. 1
148	TOT UVOL 1	Total uncorrected volume for meter No. 1
174	UNCR RATE2	Uncorrected flow rate, meter No.2
163	FLOW RATE2	Hourly flow rate for meter No.2
168	TOT VOL 2	Total accumulated volume for meter No.2
178	TOT UVOL2	Total uncorrected volume for meter No.2
213	ST TDY VOL	Station today's volume
214	YSDAY VOL	Station yesterday's volume

**5.9 DATA LOG LIST CONTENTS**

The following items are included on the data log. 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
020	METR PRES1	1	6	AVERAGE
021	FLOW TEMP1	1	4	AVERAGE
132	FLW TIME 1	1	6	SNAPSHOT & ZERO
145	LOG UVOL 1	1	6	SNAPSHOT & ZERO
135	LOG VOL 1	1	6	SNAPSHOT & ZERO
022	METR PRES2	1	6	AVERAGE
162	FLW TIME 2	1	6	SNAPSHOT & ZERO
175	LOG UVOL 2	1	6	SNAPSHOT & ZERO
165	LOG VOL 2	1	6	SNAPSHOT & ZERO

**5.10 DATA LOG HEADER BLOCK CONTENTS**

The data log header block includes the following items:

- M PRES1/LO
- M PRES1/HI
- M TEMP1/LO
- M TEMP1/HI
- M PRES2/LO
- M PRES2/HI
- LIVE SG/LO
- LIVE SG/HI
- BTU LO
- BTU HI
- METR FCTR1
- METR FCTR2

(Continued on the next page)

## Header Block Contents (Continued)

ZFLOW LIM  
ATMS PRES  
PRES BASE  
TEMP BASE  
AGA8 MTHD  
SG SELECT  
SPEC GRAV  
BTU  
CO2  
N2  
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, 11-12, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	C(19) < X	BATTERY LO	16.0	10.8	0.0	0
2	C(20) < X*S(20,F) or C(20) > Y*S(20,F)	METR PRES1	1000	0.0	1.01	0
3	C(21) < X*S(21,F) or C(21) > Y*S(21,F)	FLOW TEMP1	150.0	0.0	1.01	0
4	C(22) < X*S(22,F) or C(22) > Y*S(22,F)	METR PRES2	1000	0.0	1.01	0
5*	C(23) < X*S(23,F) or C(23) > Y*S(23,F)	AUX ANLG 5	-	0.0	1.01	0
6*	C(24) < X*S(24,F) or C(24) > Y*S(24,F)	LIVE SG	1.0	0.0	1.01	0
7*	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	LIVE BTU	1200	0.0	1.01	0
8*	C(26) < X*S(26,F) or C(26) > Y*S(26,F)	AUX ANLG 8	100	0.0	1.01	0

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	999999.0	0
10	C(30) <> 0.0	SYS ERROR		0.0	0.0	0
11	C(144) < X or C(144) > Y	UNCR RATE1	-	0.0	999999.0	0
12	C(174) < X or C(174) > Y	UNCR RATE2	-	0.0	999999.0	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.

$$F = 1000 \text{ PSIG}$$

Therefore, the alarm set point for alarm #2 is  $1.01(1000) = 1010 \text{ PSIG}$ .

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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## 6.0 DUAL TURBINE/PD APPLICATION (1P1T)

Section 6 covers the individual requirements for the dual turbine/PD application configured to calculate volume and flow rate using equations from paragraph 1.4. The dual turbine/PD application supports measurement on two meter tubes with common pressure and temperature 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 specific gravity and BTU 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 paragraph 1.13. No changes should be required unless the previously used application has been significantly different.

The wiring configuration for the dual turbine/PD with common pressure and temperature 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.				
<i>or</i>				
20	EXTERNAL, static pressure for meter 1 (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, meter 1 temperature (to be installed by user)	Blue Black Red Gray	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	None, jumper pin 31 to 34	Black Black	31 34	Signal in + Analog ground
23	None, jumper pin 35 to 38	Black Black	35 38	Signal in + Analog ground
24	EXTERNAL, LIVE SG <sup>(1) (2)</sup> (to be installed by user)		39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground
25	EXTERNAL, LIVE BTU <sup>(1) (2)</sup>		43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	None, jumper pin 47 to 50	Black Black	47 50	Signal in + Analog ground

- NOTES:**
- (1) Since fixed values are normally desired for BTU and SG, digital input channels 1 and 2 are factory-wired to ground. When live values are desired, remove the jumpers between pins 51 and 60, 52 and 61 on the rear termination board. The fixed values for BTU 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.
-

## 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 SG	LIVE SG	60 51 (GND)	Open, means use LIVE SG Shorted, means use FIXED SG
2	Live or fixed BTU	LIVE BTU	61 52 (GND)	Open, means use LIVE BTU Shorted, means use FIXED BTU
18	Chromatograph option	CHROM	68 59 (GND)	Open = no chromatograph Shorted, means use chromatograph

Following are valid combinations:

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

Note that serial chromatograph inputs require that SG and BTU 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 CONFIG submenu of the SETUP UNIT menu.

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, 6, 7, and 8 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 69	TTL Output Common
6	Volume pulse output 2	VP2	79 70	TTL Output Common
7	Valve control open	OPEN 2	80 71	TTL Output Common
8	Valve control close	CLOSE 2	81 72	TTL Output Common
13	Channel Value Monitor	CVM STATUS	84 75	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 2251 Chromatograph Controller to the Model 2470, refer to the field wiring diagram in the Model 2470 Systems Reference Manual.

MODEL 2251	MODEL 2470	
Signal Type	Pin No.	Signal Type
Serial out	102	DI in
Serial in	103	DI out
Ground	106	DI ground

### 6.2.5 TURBINE/PD INPUT CONNECTIONS

Refer to Drawing DE-11330, sheet 3 for information regarding wiring detail. The applicable ports are "PD #1" or "TURBIN #1" for meter number one and "PD #2" and "TURBIN #2" for meter number two.

**6.3 SETUP LOCATION MENU**

The SolarFlow Plus operating parameters for the enhanced dual turbine/PD 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 paragraph 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 <sup>(1)</sup>	120	_____
USER REP <sup>(2)</sup>	****	_____
PCOMM RATE <sup>(3)</sup>	1200 BPS	_____
RTS DELAY <sup>(4)</sup>	0 1/100s	_____

- 
- NOTES:**
- (1) Refer to paragraph 5.10.1.6 in the Model 2470 System Reference Manual for a complete discussion of the SEC CODE prompt.
  - (2) Refer to paragraph 5.10.1.7 in the Model 2470 System Reference Manual for a complete discussion of the USER REP prompt.
  - (3) Refer to paragraph 5.10.1.8 in the Model 2470 System Reference Manual for a complete discussion of the PCOMM RATE prompt.
  - (4) Refer to paragraph 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 enhanced dual turbine/PD 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 <sup>(1)</sup>		_____
RESET CMOD <sup>(2)</sup>	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 paragraph 1.9 for a description of the LOG DEFINE prompt.
  - (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 paragraph 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 of the enhanced dual turbine/PD 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.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>
METR PRES1	0.0 PSIG
FLOW TEMP1	0.0 DEG F
LIVE SG	0.000
LIVE BTU	0.0
BATTERY	0.0 VOLTS
AUX ANLG 4	0.0 %
AUX ANLG 5	0.0 %
AUX ANLG 8	0.0 %
FLW RT OUT	0.0 MCFH
VALVE POS	50.0 %

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 paragraph 5.10.2.3 in the Model 2470 System Reference Manual for additional information about the SCALES submenu.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>	<b>DESIRED</b>
M PRES1/LO	0 PSIG	_____
M PRES1/HI	1000 PSIG	_____
M TEMP1/LO	0.0 DEG F	_____
M TEMP1/HI	150.0 DEG F	_____
LIVE SG/LO	0.5	_____
LIVE SG/HI	1.0	_____
BTU/LO	800 MCFH	_____
BTU/HI	1200 MCFH	_____
FLW RT LOW	0.0 %	_____
FLW RT HI	5000.0 %	_____
VLV POS LO	0.0 %	_____
VLV POS HI	100.0 %	_____
AUX 4 LO	0 %	_____
AUX 4 HI	100 %	_____
AUX 5 LO	0 %	_____
AUX 5 HI	100 %	_____
AUX 8 LO	0 %	_____
AUX 8 HI	100 %	_____

6.4.4 DISCRETES SUBMENU

HHDT PROMPT	DEFAULT
VP 1	OFF
VP 2	OFF
OPEN 2	OFF
CLOSE 2	OFF
CVM STATUS	OFF
OUTPUT 14	OFF
OUTPUT 15	OFF

6.4.5 CONFIG SUBMENU

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

HHDT PROMPT	SAMPLE VALUES		DESIRED
METR FCTR1	100.00	PPCF	_____
METR FCTR2	100.00	PPCF	_____
ZFLOW LIM	15	SEC	_____
ATMS PRES	14.73	PSIA	_____
PRES BASE	14.73	PSIA	_____
TEMP BASE	60	DEG F	_____
AGA8 MTHD	0		_____
SG SELECT	0		_____
CHROM ADDR	1		_____
CHROM STRM	1		_____
VERSION	1.0		_____

## 6.4.6 GAS DATA

This enhanced SolarFlow Plus software can accept information from the Model 2251 Danalyzer Chromatograph Gas Controller. This option requires that a jumper be installed grounding digital Channel 18. Install the jumper between pin 68 and pin 58 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 paragraph 1.5.

<b>HHDT PROMPT</b>	<b>SAMPLE VALUES</b>		<b>DESIRED</b>
SPEC GRAV	0.6000		_____
BTU	1000.0		_____
CO2	0.000	MOL%	_____
N2	0.000	MOL%	_____
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 for the volume pulse outputs and valve positioning. Refer to paragraph 1.7 for more information.

HHDT PROMPT	SAMPLE VALUES		DESIRED
VPP1	100.0	MCF	_____
PP1	1.0	SEC	_____
VPP2	100.0	MCF	_____
PP2	1.0	SEC	_____
CVM CHAN #	0		_____
CVM LO LMT	0.0		_____
CVM HI LMT	5000.0		_____
TS ENABLE	0		_____
OPEN 2 SP	1000.0	ACF/H	_____
CLOSE 2 SP	4000.0	ACF/H	_____
TS DELAY	30	SECS	_____
TS VLV TIM	30	SECS	_____
VP MODE	0		_____
FLW SETPNT	0.0	MCFH	_____
PRES SETPT	100	PSIG	_____
DEADBAND	2.0	%	_____
SMALL STEP	0.05	%	_____
LARGE STEP	0.5	%	_____
FINE CNTRL	5.0	%	_____
PRES CHAN#	20		_____
OVRD PRES	0	PSIG	_____
AFR LIMIT	5000.0	ACF/H	_____
PRESET POS	100	%	_____
UPDATE TIM	10	SECS	_____
VALV 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.

<b>HHDT PROMPT</b>	<b>SAMPLE VALUES</b>	<b>DESIRED</b>
AGA8 MTHD	1	_____
ZB	1.038190	_____
FLOW RATE1	0.0 MCFH	_____
UNCR RATE1	0.0 ACF/H	_____
ZF 1	0.927767	_____
FLOW RATE2	0.0 MCFH	_____
UNCR RATE2	0.0 ACF/H	_____
ZF 2	0.927767	_____
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, CALC DATA and RATE/VOLS.

### 6.5.1 ANALOGS

METR PRES1  
FLOW TEMP1  
LIVE SG  
LIVE BTU  
BATTERY  
AUX ANLG 4  
AUX ANLG 5  
AUX ANLG 8  
FLW RT OUT  
VALV POS

### 6.5.2 SCALES

M PRES1/LO	AUX 4 LO
M PRES1/HI	AUX 4 HI
M TEMP1/LO	AUX 5 LO
M TEMP1/HI	AUX 5 HI
LIVE SG/LO	AUX 8 LO
LIVE SG/HI	AUX 8 HI
BTU/LO	
BTU/HI	
FLW RT LOW	
FLW RT HI	
VLV POS LO	
VLV POS HI	

**6.5.3 DISCRETES**

LIVE GRAV  
SG  
LIVE BTU  
CHROM  
VP 1  
VP 2  
CVM STATUS  
OPEN 2  
CLOSE 2  
INPUT 3  
INPUT 4  
INPUT 9  
INPUT 10  
INPUT 16  
INPUT 17

**6.5.4 CONFIG**

METR FCTR1  
METR FCTR2  
ZFLOW LIM  
ATMS PRES  
PRES BASE  
TEMP BASE  
AGA8 MTHD  
SG SELECT  
CHROM ADDR  
CHROM STRM  
VERSION



6.5.5 GAS DATA

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

6.5.6 CONTROL

VPP 1  
PP1  
VPP 2  
PP 2  
CVM CHAN #  
CVM LO LMT  
CVM HI LMT  
TS ENABLE  
OPEN 2 SP  
CLOSE 2 SP  
TS DELAY  
TS VLV TIM

VP MODE  
FLW SETPNT  
PRES SETPT  
DEADBAND  
SMALL STEP  
LARGE STEP  
FINE CNTRL  
PRES CHAN#  
OVRD PRESS  
AFR LIMIT  
PRESET POS  
UPDATE TIM  
VALVE POS

#### 6.5.7 CALC DATA

AGA8 MTHD  
ZB  
FLOW RATE1  
UNCR RATE1  
ZF 1  
FLOW RATE2  
UNCR RATE2  
ZF 2  
B - AGA8  
C - AGA8  
D - AGA8  
K - AGA8  
MOL WT.

6.5.8 RATE/VOLS

FLOW RATE1 (MCFH)	TDY ENERGY
FLOW RATE1 (MCFD)	YSY ENERGY
TODAY VOL1	TOT ENERGY
YSDAY VOL1	
TOT VOL 1	
FLOW RATE2 (MCFH)	
FLOW RATE2 (MCFD)	
TODAY VOL2	
YSDAY VOL2	
TOT VOL 2	
STN FLW RT (MCFH)	
STN FLW RT (MCFD)	
ST TDY VOL	
ST YSY VOL	
ST TOT VOL	
UNCR RATE1	
TDY UVOL 1	
YSY UVOL 1	
TOT UVOL 1	
UNCR RATE2	
TDY UVOL 2	
YSY UVOL 2	
TOT UVOL 2	
STN UNC RT	
ST TDY UV	
ST YSY UV	
ST TOT UV	
ERATE 1	
TDY ENRGY1	
YSY ENRGY1	
TOT ENRGY1	
ERATE 2	
TDY ENRGY2	
YSY ENRGY2	
TOT ENRGY2	
STN ERATE	

## **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 paragraph 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

### **6.6.1 PRESSURES**

The PRESSURE selection of the CALIBRATE UNIT menu provides for calibrating the pressure input listed as follows:

METR PRES1

### **6.6.2 TEMPERATURES**

The TEMP selection of the CALIBRATE UNIT menu provides for calibrating the temperature as follows:

FLOW TEMP1

### **6.6.3 OTHERS**

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

LIVE SG  
LIVE BTU  
AUX ANLG 4  
AUX ANLG 5  
AUX ANLG 8

**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. Refer to paragraph 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES1  
FLOW TEMP1  
LIVE SG  
LIVE BTU  
AUX ANLG 4  
AUX ANLG 5  
AUX ANLG 8

**6.8 USER REPORT (CHANNEL 0)**

The User Report (Channel 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 Report on the front panel in a scrolling format.

<b>CHANNEL NUMBER</b>	<b>CHANNEL LABEL</b>	<b>DESCRIPTION</b>
Header	--	Time, date, and location data
020	METR PRES1	Live pressure meter No.1 in PSIG
021	FLOW TEMP1	Live temperature in degrees Fahrenheit (°F)
024	LIVE SG	Live value for specific gravity
144	UNCR RATE1	Uncorrected flow rate, meter No.1
133	FLOW RATE1	Hourly flow rate for meter No.1
138	TOT VOL 1	Total accumulated volume for meter No. 1
148	TOT UVOL 1	Total uncorrected volume for meter No. 1
174	UNCR RATE2	Uncorrected flow rate, meter No.2
163	FLOW RATE2	Hourly flow rate for meter No.2
168	TOT VOL 2	Total accumulated volume for meter No.2
178	TOT UVOL2	Total uncorrected 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 items are included on the data log. 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
020	METR PRES1	1	6	AVERAGE
021	FLOW TEMP1	1	4	AVERAGE
132	FLW TIME 1	1	6	SNAPSHOT & ZERO
145	LOG UVOL 1	1	6	SNAPSHOT & ZERO
135	LOG VOL 1	1	6	SNAPSHOT & ZERO
162	FLW TIME 2	1	6	SNAPSHOT & ZERO
175	LOG UVOL 2	1	6	SNAPSHOT & ZERO
165	LOG VOL 2	1	6	SNAPSHOT & ZERO

**6.10 DATA LOG HEADER BLOCK CONTENTS**

The data log header block includes the following items:

- M PRES1/LO
- M PRES1/HI
- M TEMP1/LO
- M TEMP1/HI
- LIVE SG/LO
- LIVE SG/HI
- BTU LO
- BTU HI
- METR FCTR1
- METR FCTR2

(Continued on the next page)

## Header Block Contents (Continued)

ZFLOW LIM  
ATMS PRES  
PRES BASE  
TEMP BASE  
AGA8 MTHD  
SG SELECT  
SPEC GRAV  
BTU  
CO2  
N2  
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, 11-12, 0 (none) for alarm 10

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
1	C(19) < X	BATTERY LO	16.0	10.8	0.0	0
2	C(20) < X*S(20,F) or C(20) > Y*S(20,F)	METR PRES1	1000	0.0	1.01	0
3	C(21) < X*S(21,F) or C(21) > Y*S(21,F)	FLOW TEMP1	150.0	0.0	1.01	0
4*	C(22) < X*S(22,F) or C(22) > Y*S(22,F)	AUX ANLG 4	0	0.0	1.01	0
5*	C(23) < X*S(23,F) or C(23) > Y*S(23,F)	AUX ANLG 5	0	0.0	1.01	0
6*	C(24) < X*S(24,F) or C(24) > Y*S(24,F)	LIVE SG	1.0	0.0	1.01	0
7*	C(25) < X*S(25,F) or C(25) > Y*S(25,F)	LIVE BTU	1200	0.0	1.01	0
8*	C(26) < X*S(26,F) or C(26) > Y*S(26,F)	AUX ANLG 8	100	0.0	1.01	0

ALARM NO.	ALARM CONDITION	ALARM MESSAGE	VARIABLE VALUES			
			F	X	Y	Z
9	C(210) < X or C(210) > Y	STN FLW RT	-	0.0	999999.0	0
10	C(30) <> 0.0	SYS ERROR		0.0	0.0	0
11	C(144) < X or C(144) > Y	UNCR RATE1	-	0.0	999999.0	0
12	C(174) < X or C(174) > Y	UNCR RATE2	-	0.0	999999.0	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.

$$F = 1000 \text{ PSIG}$$

Therefore, the alarm set point for alarm #2 is  $1.01(1000) = 1010 \text{ PSIG}$ .

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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## **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.**

**LE PRÉSENT APPAREIL NUMÉRIQUE N'ÉMET PAS DES BRUITS RADIOÉLECTRIQUES DÉPASSANT LES LIMITES APPLICABLES AUX APPAREILS NUMÉRIQUES DE CLASSE A PRESCRITES DANS LE RÉGLEMENT SUR LE BROUILLAGE RADIOÉLECTRIQUE ÉDICTÉ PAR LE MINISTÈRE DES COMMUNICATIONS DU CANADA.**

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.

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**DANIEL**

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