MODEL 2470
SOLARFLOW PLUS
APPLICATION MANUAL

MODEL 2470 SOLARFLOW PLUS

AGA-7/AGA-3 ALTERNATE

APPLICATION MANUAL

"AGA7/3 ALT"

HHDT EPROM 8-2460-227
LC EPROM 8-2460-226
LD EPROM 8-2460-225

Part Number 3-9003-033
Revision H

APRIL 1999

DANIEL

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Year 2000 Warranty

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ii) recognize and accept the year 2000 and every succeeding fourth year as leap years;

iii) recognize and accept 29 February in the year 2000 and every succeeding fourth year;

iv) record, store, process, sequence, present and output calendar dates and data related to dates falling on or after 1 January 2000, in the same manner and with the same functionality as they do on or before 31 December 1999 and without errors or omissions; and

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DANIEL INDUSTRIES, INC.
MODEL 2470 SOLARFLOW PLUS
AGA-7/AGA-3 ALTERNATE
APPLICATION MANUAL

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LIST OF ILLUSTRATIONS

1.0 INTRODUCTION

1.1 SCOPE OF THIS MANUAL

A SolarFlow Plus unit delivered from the factory is fitted with a set of erasable, programmable, read-only memories (EPROMs) configured for the application(s) for which the SolarFlow Plus is intended. The Hand Held Data Terminal (HHDT) provided with SolarFlow Plus is compatible with all standard applications for which SolarFlow Plus is configured. This manual provides specific information on a Model 2470 SolarFlow Plus system configured for the AGA-7 / AGA-3 ALTERNATE application. 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 a specific installation of the Model 2470 SolarFlow Plus system. This manual provides references to the System Reference Manual whenever more detailed information is provided in that manual.

This manual includes sections on:

- Calculation modules for this application
- Discussion of tube switching
- 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, 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 INSTALLATION CONFIGURATION FOR THE AGA-7 / AGA-3 ALTERNATE APPLICATION WITH ONE DP TRANSMITTER PER METER TUBE

The SolarFlow Plus AGA-7 / AGA-3 ALTERNATE application is designed for installations with one turbine meter tube and two orifice meter tubes. The turbine meter has one meter pressure transmitter and one temperature transmitter. The two orifice meters each have a single differential pressure transmitter and they share additional pressure and temperature transmitters. One specific gravity input, common to all three meters, is available (SG transmitter is user supplied).

Figure 1 shows the installation configuration for the transmitters.

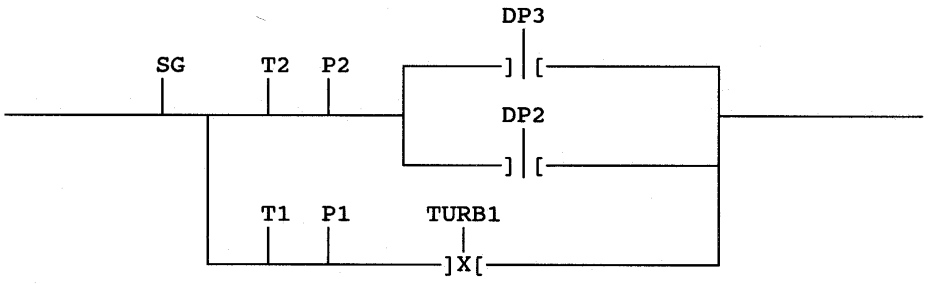

Figure 1. Transmitter Installation Configuration

2.0 CALCULATION MODULES

2.1 AGA-7 CALCULATION METHOD

This manual supports a SolarFlow Plus configured to compute measurements on tube one in accordance with the American Gas Association (AGA) Transmission Measurement Committee Report No. 7 (AGA7), Measurement of Fuel Gas by Turbine Meters, ((c) 1981). Supercompressibility is calculated in accordance with AGA Standard NX-19 - Manual for the Determination of Supercompressibility Factors for Natural Gas.

2.2 AGA-7 EQUATIONS

The equations below summarize the AGA-7 standard corrected volume calculation:

$$Vc = C' * Vu$$

Where:

Vc = corrected volume in thousands of cubic feet (MCF)
Vu = PC/M = uncorrected volume
C' = flow constant determined from:

$$C' = (((Pf + Pa)/Pb) * ((Tb + 460)/(Tf + 460)) * Fpv^2)/1000$$

Where:

PC = pulse count
M = meter factor in pulses/actual cubic foot
Pf = flowing pressure in psig
Pa = atmospheric pressure in psia
Pb = pressure base in psia
Tb = temperature base in degrees Fahrenheit
Tf = flowing temperature in degrees Fahrenheit
Fpv = NX-19 supercompressibility factor

2.3 AGA-3 CALCULATION METHOD

This manual supports a SolarFlow Plus computer configured to calculate orifice-meter measurements on tubes two and three in accordance with the American Gas Association (AGA) Gas Measurement Committee Report No.3 (AGA-3), Orifice Metering of Natural Gas, (ANSI/API 2530 Second Edition, September 1985). Supercompressibility is calculated in accordance with AGA Standard NX-19 - Manual for the Determination of Supercompressibility Factors for Natural Gas.

2.3.1 FLOW RATE

In general, the equation for calculating flow rate is:

$$Q_h = C_f \cdot (h_w \cdot P_f)^{0.5}$$

Where:

Q_h = corrected flow rate in thousands of standard cubic feet per hour (MCF/HR).

C_f = orifice flow constant calculated using the equation in 2.2

h_w = differential pressure in inches of water.

P_f = static pressure in pounds per square inch, absolute (PSIA).

2.3.2 ORIFICE FLOW CONSTANT (C_f)

The equation for calculating the orifice flow constant (C_f) is:

$$C_f = (F_b \cdot F_{pb} \cdot F_{tb} \cdot F_g \cdot F_{pv} \cdot F_r \cdot Y \cdot F_{tf} \cdot F_a)/1000$$

Where:

Fb = basic orifice factor (Reference equation 61, ANSI/API 2530).

F_{pb} = pressure base factor (Reference equation 66, ANSI/API 2530).

F_{tb} = temperature base factor (Reference equation 67, ANSI/API 2530).

F_g = specific gravity factor (Reference equation 69, ANSI/API 2530).

F_{pv} = supercompressibility factor (Reference equation 2, ANSI/API 2530).

F_{pv} calculations are limited to adjusted pressures of zero (0) to 2000 pounds per square inch, gauge and adjusted temperatures of -40 to 240 degrees Fahrenheit (^oF).

F_r = Reynolds number factor (Reference equation 62, ANSI/API 2530).

Y = expansion factor (Reference equation 17 or 18, ANSI/API 2530).

F_{tf} = flowing temperature factor (Reference equation 68, ANSI/API 2530).

F_a = orifice thermal expansion factor (Reference equation E2 or E3, ANSI/API 2530).

2.4 CALCULATION CYCLES

During normal SolarFlow Plus operation, calculations are performed continuously. Each complete set of calculations is called a calculation cycle. A calculation cycle's length varies depending on communications activity and input values, but is typically 15 to 25 seconds.

The SolarFlow Plus computer calculates the critical part of the AGA3 flow rate calculation, extension factor, $(h_w \cdot P_f)^{0.5}$, every half second. The computer calculates other factors once per calculation cycle using average input values computed from ½-second samples taken throughout the cycle.

Example:

If an application's calculation cycle is 20 seconds long, a total of 40 extension factors are calculated for each orifice tube during this time. Forty samples of each analog input are also obtained and averaged at the same time. SolarFlow Plus sums up and averages the individual extension factors then multiplies the result by the value of C_f produced by the input averages to produce a flow rate.

Similarly, AGA-7 volume increment is computed based on the same averages and the number of pulses received from the meter over the calculation cycle. AGA-7 flow rate is computed based on the volume increment for the calculation cycle. AGA-7 accumulates volume for each pulse even if the pulses are not frequent enough to generate a noticeable flow rate. At the end of each calculation cycle, SolarFlow Plus updates channels with the newly computed values.

2.5 TUBE SWITCHING

This application supports tube switching with three meter tubes. The primary meter tube, tube one, supports turbine or PD meter with AGA-7 volume calculation. Tubes two and three support orifice metering with AGA-3 volume calculation. Tube one is open when tubes two or three are closed; when tubes 2 or 3 are open, tube one is closed. When tube one is closed, tubes 2 and 3 act as a switched dual AGA-3. The application name, AGA-7 / AGA-3 Alternate, refers to the fact that the tube switching alternates between single tube AGA-7 and dual tube AGA-3.

Please note that volume is computed at all times on all tubes no matter which tubes are switched on or off.

In most cases you will only need to consider four values when configuring the tube switching system:

VALUE 1 - Channel # 101, TS1 MAX, is the maximum desired rate for tube one in actual cubic feet per hour (uncorrected). When the tube one uncorrected rate is greater than or equal to this limit, the valve for tube two is opened; then the valve for tube one is closed.

VALUE 2 - Channel # 106, TS2 MIN, is the minimum acceptable differential pressure for tube two in inches of water (InH2O). When the tube two differential pressure is less than or equal to this limit, the valve for tube one is opened; then the valve for tube two is closed.

VALUE 3 - Channel # 107, TS2 MAX, is the maximum acceptable differential pressure for tube two in inches of water. When the tube two differential pressure is greater than or equal to this limit, the valve for tube three is opened.

VALUE 4 - Channel # 111, TS3 MIN, is the minimum acceptable differential pressure for tube three in inches of water. When the tube three differential pressure is less than or equal to this limit, the valve for tube three is closed.

2.5.1 DIGITAL CHANNELS CONTROLLING THE TUBE SWITCHING VALVES

Digital channels 13, 14, 7, 8, 11, and 12 are used to control the tube switching valves. For example: Channels 13 and 14 (OPEN 1 and CLOSE 1) control the valve for tube one. When the valve should be open, the output of channel 13 is constant at five VDC (ON) and the output of channel 14 is constant at zero VDC (OFF). When the valve should be closed, the output of channel 13 is constant at zero VDC (OFF) and the output of channel 14 is constant at five VDC (ON).

The other valve control outputs work the same way. Since valve types vary widely, user supplied conditioning of these signals is usually required in order to activate the valves. Some additional specifics can be found in the drawings and channel list.

2.5.2 ADVANCED TUBE SWITCHING

This application uses high speed tube switching. This means the switch is made in real time as fast as ½-second after switching criteria have been met. There are several channels which allow the advanced tube switching user to adjust his configuration.

Channel 100, TS1 ENABLE determines whether tube one is considered part of the tube switching system. A zero value indicates disabled. A one value indicates enabled. When disabled, the digital outputs controlling this valve are frozen at their state when they were disabled. This channel can only be changed by the user. An alarm is activated whenever tube one is disabled.

Channel 101, TS1 MAX is the maximum desired rate for tube one in actual cubic feet per hour (uncorrected). When the tube one uncorrected rate is greater than or equal to this limit, the valve for tube two is opened; then the valve for tube one is closed. Tube one is not closed until after TS1-2 DLAY and TS2 VERIFY delays have elapsed. If AUT DEABLE = 1 and differential pressure for tube two does not exceed TS2 MIN, then tube two is disabled and tube three is opened.

Channel 102, TS1 RT ACC is the desired percentage accuracy for tube one rate detection for tube switching purposes. This value does not affect volume accumulation accuracy. Orifice tubes do not have this type of parameter because they switch based on instantaneous differential pressure. To determine a rate, a certain number of pulses must be received over a known length of time from the meter. Since SolarFlow Plus reads its pulse accumulators once each ½- second, the amount of time represented by any accumulated number of pulses can be computed only to plus or minus ½-second. SolarFlow Plus computes a dynamic window of time that allows determination of the current flow rate accurate to the desired percentage. One hundred percent would be perfect, and zero percent would be totally inaccurate. The larger the value the slower the tube switching response for tube one. For meters that generate a large number of pulses for a small amount of gas, the worst case degradation in tube switching response can be less than ½-second; in such cases it does not hurt to set the accuracy near 100 percent. On the other hand, if you set accuracy at 50 percent and put the switch limit at 100 ACF/H, a switch might occur as early as 50 ACF/H or as late as 150 ACF/H. At very low pulse rates it may be impossible for SolarFlow Plus to compute an accurate tube switching rate. Experimentation can determine what combination is best for your system.

Channel 103, TS1 VERIFY is the number of seconds the rate for tube one must be greater than or equal to the maximum before the SolarFlow Plus will decide to switch to tube two.

Channel 104, TS1-2 DLAY is the number of seconds the tube switching system will wait after switching from tube one to tube two or from tube two to tube one before making any other decisions. It is intended to reflect the amount of time required for the valve to open or close.

Channel 105, TS2 ENABLE determines whether tube two is considered part of the tube switching system. A zero value indicates disabled. A one value indicates enabled. When disabled, the digital outputs controlling this valve are frozen at their state when they were disabled. This channel can be changed by the user or automatically by SolarFlow Plus. When attempting to open tube two, if the TS1-2 DLAY and the TS2 VERIFY delays have expired and the differential pressure of tube two still has not exceeded TS2 MIN and AUT DEABLE = 1, SolarFlow Plus will set this channel to zero (disabled). An alarm is activated whenever tube two is disabled.

Channel 106, TS2 MIN is the minimum acceptable differential pressure for tube two in inches of water. When tube two differential pressure is less than or equal to this limit, the valve for tube one is opened and the valve for tube two is closed. Tube two is not closed until the TS1-2 DLAY delay has expired.

Channel 107, TS2 MAX is the maximum acceptable differential pressure for tube two in inches of water. When tube two differential pressure is greater than or equal to this limit, the valve for tube three is opened.

Channel 108, TS2 VERIFY is the number of seconds the differential pressure for tube two must be greater than or equal to the maximum before the SolarFlow Plus will decide to switch on tube three - OR - the number of seconds the differential pressure for tube two must be less than or equal to the minimum before the SolarFlow Plus will decide to switch to tube one.

Channel 109, TS2-3 DLAY is the number of seconds the tube switching system will wait after switching from tube two to tube three or from tube three to tube two before making any other decisions. It is intended to reflect the amount of time required for the valve to open or close.

Channel 110, TS3 ENABLE determines whether tube three is considered part of the tube switching system. A zero value indicates disabled. A one value indicates enabled. When disabled, the digital outputs controlling this valve are frozen at the state when they were disabled. This channel can be changed by the user or automatically by SolarFlow Plus. When attempting to open tube three, if the TS2-3 DLAY and the TS3 VERIFY delays have expired and the differential pressure of tube three still has not exceeded TS3 MIN and
AUT DEABLE = 1, SolarFlow Plus will set this channel to zero (disabled). An alarm is activated whenever tube three is disabled.

Channel 111, TS3 MIN is the minimum acceptable differential pressure for tube three in inches of water. When the tube three differential pressure is less than or equal to this limit, the valve for tube three is closed.

Channel 112, TS3 VERIFY is the number of seconds the differential pressure for tube three must be less than or equal to the minimum before the SolarFlow Plus will decide to switch to tube two.

3.0 FIELD WIRING CONNECTIONS

NOTE

Before connecting analog inputs to the SolarFlow Plus unit, verify that slide switch settings are in the correct positions. See paragraph 3.3.3. Section 4 of the Model 2470 SolarFlow Plus System Reference Manual provides detailed information on slide switch settings.

3.1 ANALOG INPUT CONNECTIONS

Analog inputs for the AGA-7/AGA-3 ALTERNATE application of the Model 2470 SolarFlow Plus are connected in accordance with the following table.

NOTE

Configurations for this application include the static pressure and DP transmitter(s) associated with tube two installed within the Model 2470 enclosure with all other transmitters installed externally, or with all transmitters installed externally. The following information furnishes necessary details for wiring both internal and external transmitters.

A field wiring diagram is provided in the Model 2470 System Reference Manual.

Channel	Transmitter Type	Wire Color	Pin No.	Signal Type
20	INTERNAL, static pressure, meter tube 1	(Blue*) White (Black*) Green (Red*) Black	23 26 25	Signal in + Analog ground 8 to 10 VDC
OR				
20	EXTERNAL, static pressure, meter tube 1	Blue Black Red Shield	23 26 25 24	Signal in + Analog ground 8 to 10 VDC Earth ground

Channel	Transmitter Type	Wire Color	Pin No.	Signal Type
21	EXTERNAL, specific gravity (1) meter tubes No. 1, 2 & 3	(2)	27 30 29 28	Signal in + Analog ground 8 to 10 VDC Earth ground
22	EXTERNAL, temperature, meter tube No. 1	Blue Black Red Shield	31 34 33 32	Signal in + Analog ground 8 to 10 VDC Earth ground
23	EXTERNAL, static pressure, meter tubes No. 2 & 3	Blue Black Red Shield	35 38 37 36	Signal in + Analog ground 8 to 10 VDC Earth ground
24	INTERNAL, differential pressure, meter tube No. 2	Violet Black Gray	39 42 41	Signal in + Analog ground 8 to 10 VDC
OR				
24	EXTERNAL, differential pressure, meter tube No. 2	Blue Black Red Shield	39 42 41 40	Signal in + Analog ground 8 to 10 VDC Earth ground
25	EXTERNAL, differential pressure, meter tube No. 3	Blue Black Red Shield	43 46 45 44	Signal in + Analog ground 8 to 10 VDC Earth ground
26	EXTERNAL, temperature, meter tube No. 2 & 3	Blue Black Red Shield	47 50 49 48	Signal in + Analog ground 8 to 10 VDC Earth ground

* SolarFlow Plus units fitted with Statham 36PG series static pressure transmitters are wired with the Blue, Black, and Red wires.

NOTES:

(1) Since fixed values are normally desired for SG, digital input channel 1 is factory-wired to ground. When live values are desired, remove the wire between pins 51 and 60 on the rear termination board and connect the live input. The fixed value for the specific gravity is entered in the CONFIG submenu of the SETUP UNIT menu by keying in the desired value. Refer to the System Wiring Diagram.

(2) The wire for connecting the specific gravity transmitter is user supplied.

3.2 STATUS INPUT CONNECTIONS

This application supports one status input that is activated by means of a dry contact closure between the status input pin number and common. Following are the details of the pin-out arrangement for the status input.

Channel	Signal Description	(Label)	Pin No.	Signal Type
1	Use live or fixed Specific Gravity Value	(FIXED)	60 51	Status In (OPEN) indicates, Use LIVE SG Common (SHORTED) indicates, Use FIXED SG

3.2.1 VOLUME PULSE INPUT

This application supports one pulse input that may be configured for either Turbine or Positive Displacement (PD) meter pulses. Typically, Turbine pulses are two wire higher frequency (more than 50 Hz) signals produced by a coil where PD pulses are low frequency (not greater than 50 Hz) contact closures. Turbine or PD pulse input can be chosen with slide switches on the Model 2470 SolarFlow Plus computer board. The following details the pinouts and switch settings for each type of input.

Signal	Input Pin #	GND Pin #	S3-1	S3-2
TURBIN #1 PD #1	5 & 6 11	7 12	OFF ON	ON OFF

Refer to Drawing DE-11330 (System Reference Manual) and its associated notes for additional information on wiring detail and turbine frequency and attenuation ranges.

3.3 OUTPUT SIGNAL CONNECTIONS

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 below in the discussion of the CONFIG submenu of the
SETUP UNIT menu.

3.3.1 FORM-A RELAY OUTPUT

Output from the form-A relays are shown in the following table.

Channel	Signal Description	(Label)	Pin No.	Signal Type
5	Volume pulse output No.1	(VP1)	15 16	Form-A relay
6	Volume pulse output No.2	(VP2)	17 18	Form A relay

3.3.2 TTL LEVEL SIGNAL OUTPUTS

TTL level outputs for channels five and six are available at the termination board pin numbers shown in the following table. Also shown are the tube switching output signals.

Channel	Signal Description	(Label)	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	Open 2 (+5VDC= open= ON)		80 71	TTL Output Common
8	Close 2 (+5VDC= close= ON)		81 72	TTL Output Common
11	Open 3 (+5VDC= open= ON)		82 73	TTL Output Common
12	Close 3 (+5VDC= close= ON)		83 74	TTL Output Common
13	Open 1 (+5VDC= open= ON)		84 75	TTL Output Common
14	Close 1 (+5VDC= close= ON)		85 76	TTL Output Common

3.3.3 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 2 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 3 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 3.3.3.1.** 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 2.)

Switch Set	**Switch Position**	**Configuration in ON position**
S1-1	N/A	Reserved
S1-2	N/A	Reserved
S3-1	OFF	PD meter inactive
S3-2	ON	Turbine meter active
S2-1	ON	Always ON
S2-2	N/A	Reserved
S2-3	N/A	Reserved
S2-4	N/A	Reserved
Switches S2-5 through S2-8 should always be set to 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
S4-4	OFF	Relay K2 activated by Channel 8

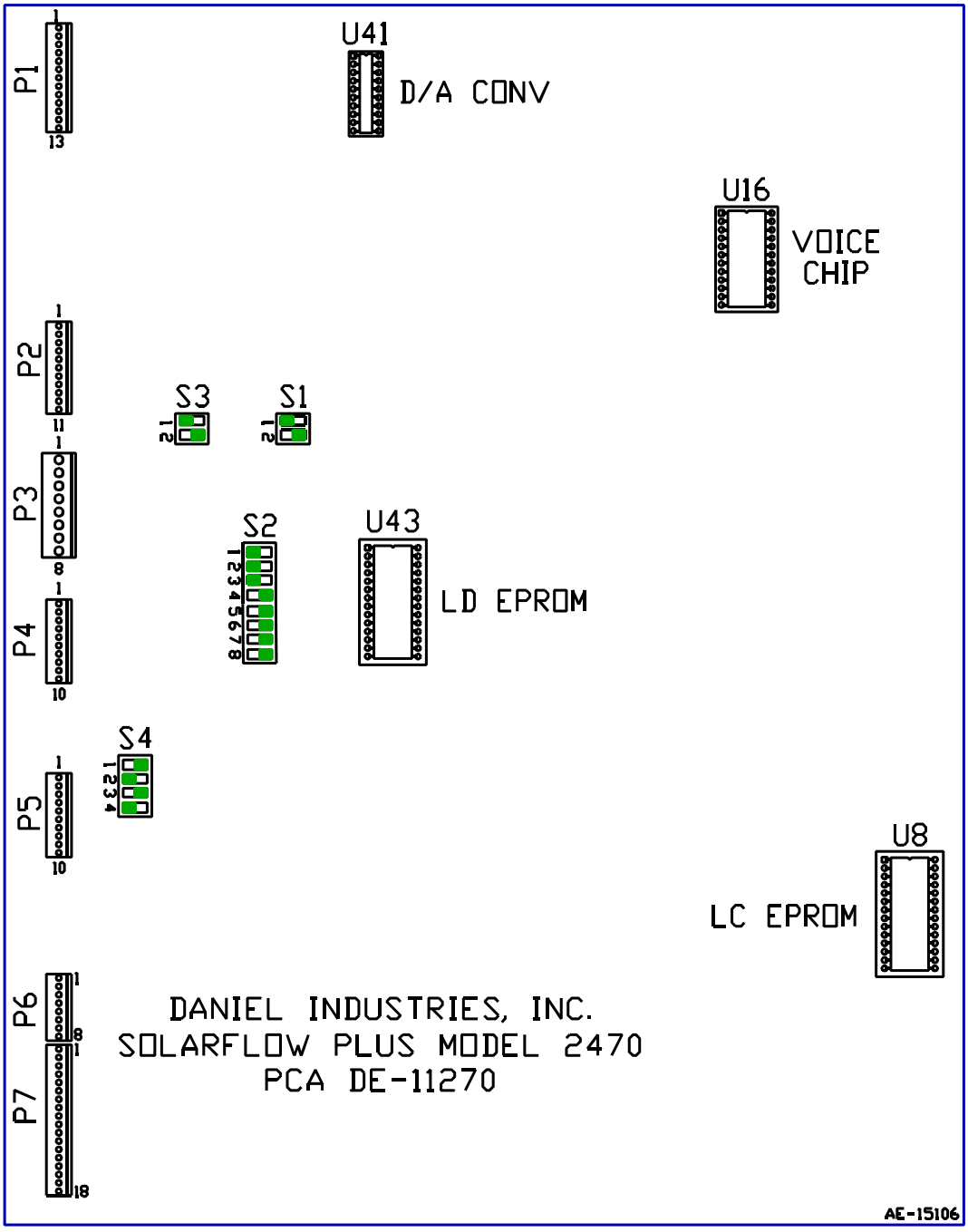

Figure 2. Model 2470 Slide Switch Locations
(PC Board Assembly Part No. 3-2470-000)

3.3.3.1 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 3 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 3.)

Switch Set	**Switch Position**	**Configuration in ON position**
SW1-1	OFF	Turbine Meter No. 1 Active
SW1-2	ON	Low Speed PD (not active with turbine meter)
SW2-1	N/A	Turbine Meter No. 2
SW2-2	N/A	PD No. 2 (not active with turbine meter)
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 for future use
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

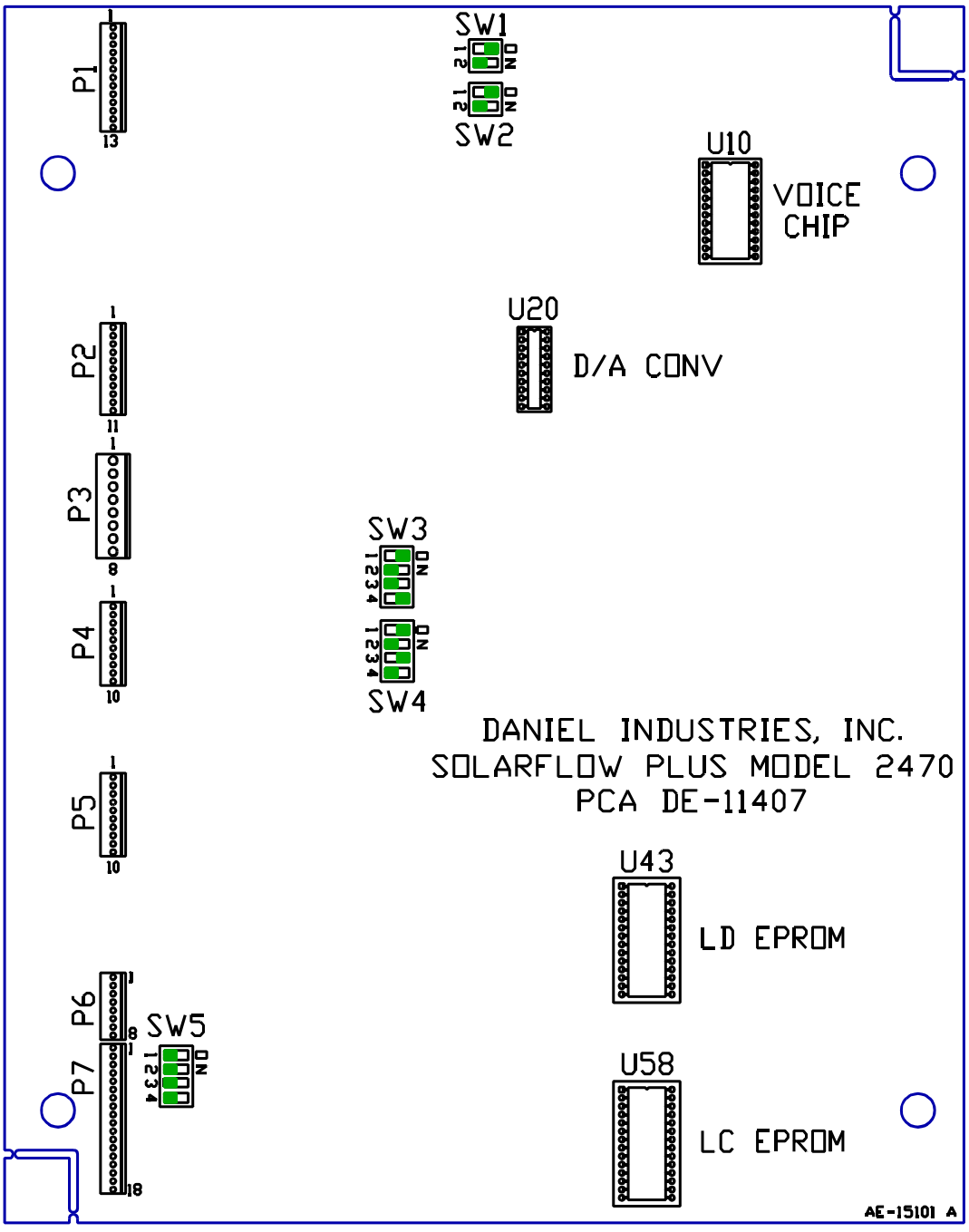

Figure 3. Model 2470 Slide Switch Locations,
(PC Board Assembly Part No. 3-2470-008)

4.0 SETUP LOCATION MENU

The SolarFlow Plus operating parameters 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.(1)

HHDT Prompt	Default	Desired
LOCATION NAME	BLANK LOCATION	
LOCATION ID	0	
DATE	010180 MMDDYY	
WEEK DAY	1 (1-7)	
TIME	0000 HHMM	
SEC CODE	120	
USER REP(2)	19	
PCOMM RATE(3)	300 BPS	
RTS DELAY(4)	0 1/100 SEC	

NOTES:

(1) After approximately five minutes of inactivity (nothing keyed in on the keypad), the HHDT times out and turns itself off. The HHDT must be disconnected from the SolarFlow Plus unit and reconnected before communications can be reestablished.

(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.

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5.0 SECURITY CODE LIST

The default security code list for this application is: 120, 101, 111, 121, 131, 141, 102, 112, 122, 132, 142.

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6.0 SETUP UNIT Menu

The parameters for the dual-meter AGA-3 application of SolarFlow Plus that can be changed in the four submenus of the SETUP UNIT menu using the HHDT are tabulated as follows. 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.

6.1 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	_____
LOG INTRVL	1	_____
LOG DEFINE(1)		

NOTES:

(1) Before making changes in the LOG DEFINE Submenu, collect all data logs in SolarFlow Plus memory. All data logs in 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 11.3 for a description of the LOG DEFINE prompt.

6.2 INPUTS SUBMENU

The INPUTS submenu of the SETUP UNIT menu of the HHDT provides for toggling between LIVE and FIXED values of the analog inputs shown as follows. Refer to paragraph 5.10.2.2 in the Model 2470 System Reference Manual for additional information about the INPUTS submenu.

HHDT Prompt	Default
METR PRES1	xxxxx PSIG
ACTUAL SG	xxxxx
METR TEMP1	xxxxx DEGF
METR PRES2	xxxxx PSIG
DIFF PRES2	xxxxx INH2O
DIFF PRES3	xxxxx INH2O
METR TEMP2	xxxxx DEGF

6.3 SCALES SUBMENU

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

HHDT Prompt	Default		Desired
M PRES1/LO	0	PSIG	
M PRES1/HI	1000	PSIG	
ACT SG/LO	0.5		
ACT SG/HI	0.8		
M TEMP1/LO	0	DEGF	
M TEMP1/HI	150	DEGF	
M PRES2/LO	0	PSIG	
M PRES2/HI	1000	PSIG	
D PRES2/LO	0	INH2O	
D PRES2/HI	100	INH2O	
D PRES3/LO	0	INH2O	
D PRES3/HI	100	INH2O	
M TEMP2/LO	0	DEGF	
M TEMP2/HI	150	DEGF	
FRT OUT/LO	0	CF/HR	
FRT OUT/HI	5000000	CF/HR	

6.4 CONFIG SUBMENU

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

HHDT Prompt	Default		Desired
PIPE DIAM2	8.071	IN	
PIPE DIAM3	8.071	IN	
ORIF DIAM2	4.000	IN	
ORIF DIAM3	4.000	IN	
ATMS PRES	14.70	PSIA	
PRES BASE	14.73	PSIA	
TEMP BASE	60	DEGF	
ALTRN SG	0.600		
ALTRN BTU	1000		
FIXED CO2	0.00	MOL%	
FIXED N2	0.00	MOL%	
TAP LCTN	0		0 = DOWNSTREAM 1 = UPSTREAM
TAP TYPE	0		0 = FLANGE 1 = PIPE
ORIF MATRL	0		0 = STEEL 1 = MONEL
VPP1[1]	0.0	MCF	MCF/PULSE
PP1[2]	0	SEC	PULSE PERIOD
VPP2[1]	0.0	MCF	MCF/PULSE
PP2[2]	0	SEC	PULSE PERIOD
LFLOW LMT	1.0	InH20	
% DEV	0	%RANG	
TS1 ENABLE	1		

CONFIG SUBMENU (Continued)

HHDT Prompt	Default		Desired
TS1 MAX	99999999	ACF/H	
TS1 RT ACC	90	%	
TS1 VERIFY	2	SEC	
TS1-2 DLAY	30	SEC	
TS2 ENABLE	1		
TS2 MIN	15.0	InH2O	
TS2 MAX	80.0	InH2O	
TS2 VERIFY	2	SEC	
TS2-3 DLAY	30	SEC	
TS3 ENABLE	1		
TS3 MIN	15.0	InH2O	
TS3 VERIFY	2	SEC	
AUT DEABLE	0		

NOTES:

(1) VPP1 and VPP2 are not the same as the outputs on channel 5 (VP1) and channel 6 (VP2). VP1 and VP2 are output pulses representing corrected station volume. VPP1 and VPP2 are scaling factors for VP1 and VP2 in thousands of cubic feet per pulse (MCF per pulse). The number of cubic feet per pulse can be modified using the HHDT. To accommodate an external totalizer that advances in increments of 100 standard cubic feet (SCF) per pulse, the default value of VPP1 and VPP2 would be reset to .1MCF per pulse.

(2) The pulse period can be modified using the HHDT. As indicated in the table, no pulses are generated by PP1 and PP2 since the pulse period is set at zero (0) seconds. The value can be changed to provide a pulse to drive an external device. For example, resetting PP1 or PP2 to one (1) would generate a one second pulse period (½ second on, ½ second off). The value for PP1 or PP2 must be an integer equal to one (1) or greater. Fractions of a second are not permitted. Setting pulse period to zero clears any pending pulses.

6.5 FACTORS SUBMENU

The FACTORS submenu of the SETUP UNIT menu of the HHDT provides for toggling between LIVE and FIXED values for the calculated factors shown in the following table. Refer to paragraph 5.10.2.5 in the Model 2470 System Reference Manual for additional information about the FACTORS submenu.

HHDT Prompt	Default
METR FCTR	xxxx
FB FCTR 2	xxxx
FB FCTR 3	xxxx
FPB FCTR	xxxx
FTB FCTR	xxxx
FG FCTR	xxxx
FPV FCTR 1	xxxx
FPV FCTR 2	xxxx
FPV MTHD	0 (0= STANDARD; 1= ALTERNATE, i.e.: use manual Padj & Tadj)
PADJ FCTR	0.000
TADJ FCTR	0.000
FR FCTR 2	xxxx
FR FCTR 3	xxxx
FTF FCTR2	xxxx
Y FCTR 2	xxxx
Y FCTR 3	xxxx
FA FCTR	xxxx

7.0 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 five selections: INPUTS, STATUS, SCALES, RATE/VOLS, CONFIG, and FACTORS.

INPUTS
- BATTERY
- METR PRES1
- ACTUAL SG
- METR TEMP1
- METR PRES2
- DIFF PRES2
- DIFF PRES3
- METR TEMP2

STATUS
- FIXED
- VP1
- VP2
- OPEN 2
- CLOSE 2
- OPEN 3
- CLOSE 3
- OPEN 1
- CLOSE 1

SCALES
- M PRES1/LO
- M PRES1/HI
- ACT SG/LO
- ACT SG/HI
- M TEMP1/LO
- M TEMP1/HI
- M PRES2/LO
- M PRES2/HI
- D PRES2/LO
- D PRES2/HI
- D PRES3/LO

D PRES3/HI
M TEMP2/LO
M TEMP2/HI
FRT OUT/LO
FRT OUT/HI

RATE/VOLS
TOT UVOL1
TOT CVOL 1
TOT VOL 2
TOT VOL 3
FLOW RATE1
FLOW RATE2
FLOW RATE3
TOT VOL
FLOW RATE
TDY VOL 1
TDY VOL 2
TDY VOL 3
TDY VOL
YDY VOL

CONFIG
PIPE DIAM2
PIPE DIAM3
ORIF DIAM2
ORIF DIAM3
ATMS PRES
PRES BASE
TEMP BASE
ALTRN SG
ALTRN BTU
FIXED CO2
FIXED N2
TAP LCTN
TAP TYPE
ORIF MATRL
VPP1
PP1
VPP2

PP2
LFLOW LIM
%DEV
TS1 ENABLE
TS1 MAX
TS1 RT ACC
TS1 VERIFY
TS1-2 DLAY
TS2 ENABLE
TS2 MIN
TS2 MAX
TS2 VERIFY
TS2-3 DLAY
TS3 ENABLE
TS3 MIN
TS3 VERIFY
AUT DEABLE

FACTORS
METR FCTR
FB FCTR 2
FB FCTR 3
FPB FCTR
FTB FCTR
FG FCTR
FPV FCTR 1
FPV FCTR 2
FPV MTHD
PADJ FCTR
TADJ FCTR

FACTORS (CONT)
FR FCTR 2
FR FCTR 3
FTF FCTR2
Y FCTR 2
Y FCTR 3
FA FCTR

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8.0 CALIBRATE UNIT Menu

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 two selections: PRESSURES and OTHERS. Refer to paragraph 5.11 in the Model 2470 System Reference Manual for additional information on the CALIBRATE UNIT menu.

8.1 ACCEPTING AND REJECTING CALIBRATION

SolarFlow Plus has a built-in reference table that correlates the 1-to-5 volt analog inputs to a bit count.

If the deviation between the "expected" (VALUE DISPLAYED) and the "actual" (user entered value) bit count is less than 25 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" bit count is greater than 25 percent, the HHDT will display "OVER-DEVIATION CALIBRATION REJECTED". No EVENT log record will be made, and SolarFlow Plus will use the prior calibration data. This is case 2. Re-check the calibration. If calibration is still rejected, refer to the Problem Diagnoses in Section 7 of the System Reference Manual.

	ACTUAL (XMTR)	**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:

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

8.2 PRESSURES

The PRESSURES selection of the CALIBRATE UNIT menu provides for calibrating the pressure inputs listed below. LOW BIAS is calibrated under the differential pressure entry.

METR PRES1
METR PRES2
DIFF PRES2
DIFF PRES3

8.3 OTHERS

The analog inputs listed as follows are calibrated in the OTHERS selection of the CALIBRATE UNIT menu.

ACTUAL SG
METR TEMP1
METR TEMP2

9.0 MONITOR Menu

The Monitor menu provides for witness testing analog inputs to the SolarFlow Plus unit. When the MONITOR menu is entered, all analog inputs are fixed at the values being transmitted to SolarFlow Plus when MONITOR is executed. The values remain fixed until the MONITOR menu is exited. The analog inputs listed below are available in the MONITOR menu in the dual-meter AGA-3 application. Refer to paragraph 5.13.8 in the Model 2470 System Reference Manual for additional information on the MONITOR menu.

METR PRES1
ACTUAL SG
METR TEMP1
METR PRES2
DIFF PRES2
DIFF PRES3
METR TEMP2

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10.0 AGA-7/AGA-3 ALTERNATE CHANNEL ASSIGNMENTS

10.1 USER REPORT (CHANNEL ZERO)

Channel 0 (zero) is a pre-defined report list containing a report header and the channel data shown in the following table. The SolarFlow Plus unit displays the Users Report on the front panel in a scrolling format.

Channel Number	Channel	Description
Header	–	Time, date, and location data
19	BATTERY	Battery voltage
20	METR PRES1	Live pressure, tube 1
21	ACTUAL SG	Live SG, tubes 1, 2, & 3
22	METR TEMP1	Live temperature, tube 1
23	METR PRES2	Live pressure, tubes 2 & 3
24	DIFF PRES2	Live DP, tube 2
25	DIFF PRES3	Live DP, tube 3
26	METR TEMP2	Live temperature, tubes 2 & 3
74	TOT VOL	Total volume, tubes 1, 2, & 3
76	FLW RT	Flow rate, tubes 1, 2, & 3

10.2 CHANNEL ONE THROUGH 18 ASSIGNMENTS

Assignments for the AGA-7 / AGA-3 Alternate application channels one through 18 are tabulated as follows.

Channel	Label	Input/Output	0-Label	1-Label	Default	Description
# 1	FIXED	Inp	YES	NO	--	Use fixed gas components
2 through 4 are reserved for later use						
5	VP 1	Out	OFF	ON	OFF	Volume pulse output 1
6	VP 2	Out	OFF	ON	OFF	Volume pulse output 2
7	OPEN 2	Out	OFF	ON		Open meter run 2
8	CLOSE 2	Out	OFF	ON		Close meter run 2
9 through 10 are reserved for later use						
11	OPEN 3	Out	OFF	ON		Open meter run 3
12	CLOSE 3	Out	OFF	ON		Close meter run 3
13	OPEN 1	Out	OFF	ON		Open turbine run
14	CLOSE 1	Out	OFF	ON		Close turbine run
15 through 18 are reserved for later use						

The "0-Label" for a status input, "Inp", lists the condition of the input when it is shorted to common. The "1-Label" lists the condition of the input when it is left open. For example, Channel 1 is a status input labeled "FIXED" which is used to signify the use of fixed gas components values in the calculations. The "0-Label" is "YES" which means "use the FIXED value". The "1-Label" is "NO" which means do not use the FIXED value, use the LIVE value.

10.3 CHANNEL 19 THROUGH 113 ASSIGNMENTS

Assignments for the AGA-7 / AGA-3 Alternate channels 19 through 113 are tabulated as follows. The column labeled DP in the table indicates the number of points displayed past the decimal point.

Channel	Ref	Label	Units	DP	Default	Description
19	--	BATTERY	VOLTS	1	--	Scale 3.2-16
20	Pf	METR PRES1	PSIG	0	--	Turbine run pressure Scale 0-1000
21	G	ACTUAL SG	(none)	3	--	Actual specific gravity-Scale 0.500-0.800
22	Tf	METR TEMP1	DEG F	0	--	Scale 0-150
23	Pf	METR PRES2	PSIG	0	--	Meter 2/3 pressure Scale 0-1000
24	Hw	DIFF PRES2	InH2O	1	--	Meter 2 DP Scale 0-100.0
25	Hw	DIFF PRES3	InH2O	1	--	Meter 3 DP Scale 0-100.0
26		METR TEMP2	DEGF	0	--	Meter 2/3 Temperature Scale 0-150
27		FLW RT OUT	CF/HR	0	--	Cubic feet per hour Scale 0-5000000
28 Reserved for later use						
29		METR FCTR	(none)	1	100.0	Pulse per actual cubic foot - Turbine run
30	D	PIPE DIAM2	In	3	8.071	Meter 2 pipe diameter
31	D	PIPE DIAM3	In	3	8.071	Meter 3 pipe diameter
32	d	ORIF DIAM2	In	3	4.000	Meter 2 orifice diam
33	d	ORIF DIAM3	In	3	4.000	Meter 3 orifice diam
34		TOT UC VOL	MCF	1	0.0	Turbine run uncorr volume
35	Pa	ATMS PRES	PSIA	2	14.70	Atmospheric pressure

36	Pb	PRES BASE	PSIA	2	14.73	Pressure base
37	Tb	TEMP BASE	DEG F	0	60	Temperature base
38		ALTRN SG	(none)	3	0.600	Fixed spec gravity
39		ALTRN BTU	(none)	0	1000	Fixed BTU/SCF
40		CO2	MOL%	2	0.00	Fixed Carbon dioxide
41		N2	MOL%	2	0.00	Fixed Nitrogen
42		TAP LCTN	(none)	0	0	Location:Downstream=0 Upstream=1
43		TAP TYPE	(none)	0	0	Tap type:Flange=0 Pipe=1
44		LOG UVOL1	MCF	1	0.0	Turbine logged uncorr vol
45	Fb	FB FCTR 2	(none)	1	1.0	Meter 2 orifice factor
46	Fb	FB FCTR 3		1	1.0	Meter 3 orifice factor
47	Fpb	FPB FCTR	(none)	4	1.0000	Pressure base factor
48	Ftb	FTB FCTR	(none)	4	1.0000	Temperature base factor
49	Fg	FG FCTR	(none)	4	1.0000	Gravity factor
50	Fpv	FPV FCTR 1	(none)	4	501.0000	Turbine 1 super-compressibility factor
51	Fpv	FPV FCTR 2	(none)	4	1.0000	Meter 2/3 super-compressibility factor
52 Reserved						
53		FPV MTHD	(none)	0	0	0=Standard,1=Alternate
54		PADJ FCTR	(none)	3	0.000	NX-19 Press. Adj.factor
55		TADJ FCTR	(none)	3	0.000	NX-19 Temp. Adj.factor
56 Reserved						
57	Fr	FR FCTR 2	(none)	4	1.0000	Meter 2 Reynolds number factor
58	Fr	FR FCTR 3	(none)	4	1.0000	Meter 3 Reynolds number factor

59	Ftf	FTF FCTR 2	(none)	4	1.0000	Meter 2/3 flowing temperature factor
60	Y	Y FCTR 2	(none)	4	1.0000	Meter 2 Expansion factor
61	Y	Y FCTR 3	(none)	4	1.0000	Meter 3 Expansion factor
62		ZFLOW LIM	SEC	0	300	Time limit for no-flow condition
63	Fa	FA FCTR	(none)	4	1.0000	Thermal expansion factor
64		ORIF MATRL	(none)	0	0	Orifice material: 0-steel 1-monel
65	V	TOT CVOL 1	MCF	1	0.0	Turbine run corr vol
66	V	TOT VOL 2	MCF	1	0.0	Meter 2 accum volume
67	V	TOT VOL 3	MCF	1	0.0	Meter 3 accum volume
68		LOG CVOL 1	MCF	1	0.0	Turbine run logged volume
69		LOG VOL 2	MCF	1	0.0	Meter 2 logged volume
70		LOG VOL 3	MCF	1	0.0	Meter 3 logged volume
71		FLOW RATE1	MCF/D	1	0.0	Turbine meter flow rate
72		FLOW RATE2	MCF/D	1	0.0	Meter 2 flow rate
73		FLOW RATE3	MCF/D	1	0.0	Meter 3 flow rate
74		TOT VOL	MCF	1	0.0	Station accum volume
75		LOG VOL	MCF	1	0.0	Station logged volume
76		FLW RT	MCF/D	1	0.0	Station flow rate
77		TDY VOL 1	MCF	1	0.0	Turbine meter day's volume
78		TDY VOL 2	MCF	1	0.0	Meter 2 vol since cntrct
79		TDY VOL 3	MCF	1	0.0	Meter 3 vol since cntrct
80		TDY VOL	MCF	1	0.0	Station today's volume
81		YDY VOL	MCF	1	0.0	Station yesterday's volume
82		LOG MMBTU	(none)	0	0	Station MMBTU

83		VPP 1	MCF	1	0.0	Volume per pulse 1
84		PP 1	SEC	0	0	Pulse period 1
85		PC 1	(none)	0	0	Total pulses 1
86		VPP 2	MCF	1	0.0	Volume per pulse 2
87		PP 2	SEC	0	0	Pulse period 2
88		PC 2	(none)	0	0	Total pulses 2
89		LFLOW LIM	InH2O	1	1.0	Low Flow limit cutoff
90		%DEV	%RANG	0	0	0=Normal under/over range fault bits; Non-zero; see paragraph 11.4
91-99 Reserved						
100		TS1 ENABLE		0	1	Tube Switch 1 Enable (1=enable) (0=disable)
101		TS1 MAX	ACF/H	0	99999999	Tube Switch 1 max rate
102		TS1 RT ACC	%	0	90	Tube switch 1 max rate accuracy
103		TS1 VERIFY	SEC	0	2	Tube switch 1 rate verification delay
104		TS1-2 DLAY	SEC	0	30	Tube switch 1 to 2 valve delay
105		TS2 ENABLE	(none)	0	1	Tube switch 2 enable (1=enable) (2=disable)
106		TS2 MIN	InH2O	1	15.0	Tube switch 2 min differential
107		TS2 MAX	InH2O		80.0	Tube switch max differential
108		TS2 VERIFY	SEC	0	2	Tube switch 2 differential verification delay
109		TS2-3 DLAY	SEC	0	30	Tube switch 2 to 3 valve delay
110		TS3 ENABLE	(none)	0	1	Tube switch 3 enable (1=enable) (0=disable)

111		TS3 MIN	InH2O	1	15.0	Tube switch 3 min differential
112		TS3 VERIFY	SEC	0	2	Tube switch 3 differential verification delay
113		AUT DEABLE	(none)	0	0	0=Tube switching will not automatically disable a tube;1=Tube switching may automatically disable a tube

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11.0 DATA LOG LIST AND HEADER BLOCK

11.1 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
24	DIFF PRES2	1	6	AVERAGE
25	DIFF PRES3	1	6	AVERAGE
20	METR PRES1	0	6	AVERAGE
22	METR TEMP1	0	6	AVERAGE
44	LOG UVOL1	1	8	SNAPSHOT & ZERO
68	LOG CVOL	1	8	SNAPSHOT & ZERO
69	LOG VOL 2	1	8	SNAPSHOT & ZERO
70	LOG VOL 3	1	8	SNAPSHOT & ZERO
23	METR PRES2	0	6	AVERAGE
26	METR TEMP2	0	6	AVERAGE

11.2 DATA LOG HEADER BLOCK CONTENTS

The data log header block includes the following items:

M PRES1/LO
M PRES1/HI
ACT SG/LO
ACT SG/HI
M TEMP1/LO
M TEMP1/HI
M PRES2/LO
M PRES2/HI
D PRES2/LO
D PRES2/HI
D PRES3/LO
D PRES3/HI
M TEMP2/LO
M TEMP2/HI
PIPE DIAM2
PIPE DIAM3
ORIF DIAM2
ORIF DIAM3
ATMS PRES
PRES BASE
TEMP BASE
ALTRN SG
ALTRN BTU
FIXED CO2
FIXED N2
TAP LCTN
TAP TYPE
ORIF MATRL
VPP1
PP1
VPP2
PP2
LFLOW LIM
TS1 MAX
TS2 MIN
TS2 MAX

TS3 MIN
FRT OUT/LO
FRT OUT/HI
%DEV

11.3 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 five-character alphanumeric entry defines the item to be logged. For example, the five characters **20A61** are defined as follows by the characters ChTLD:

Ch: channel number, which is 20 in the example 20A61
T: type of log, which is A in the example 20A61. 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 20A61
D: number of decimal places to be printed, which is 1 in the example 20A61.

Therefore, 20A61 is decoded to mean that the item to be logged is an input from channel 20 (Metr Pres1), with a value averaged over the logged interval. The item has six digits with one number after the decimal point when printed with the HHDT.

11.4 REDEFINED OVER/UNDER RANGE FAULT BITS

When Channel 90, %DEV, is zero, the under-range and over- range fault bits in the data log function normally. When %DEV is changed to some non-zero value, the meaning of the fault bits is changed such that the item labeled "under-range" indicates under or over range and the item labeled "over-range" indicates a deviation during the log interval. The deviation is computed internally in the SolarFlow Plus by:

- averaging each analog input over the log interval
- computing the maximum of each input over the log interval
- computing the minimum of each input over the log interval
- computing the deviation, as a percentage of full scale, of both maximum and minimum from the average.

If the deviation is greater than or equal to the non-zero value the operator has configured into %DEV, then the deviation fault bit for that input is set.

12.0 ALARM DEFI NITIONS

The following is a listing of the Alarm definitions for this application.

Number of Retries: 5 for alarms 2-7
0 (none) for alarms 1, 8-12

Alarm Number	Alarm Condition	Alarm Message	Variable Values			
			F	X	Y	Z
1	C(19) < X	BATTERY	–	10.8	0	0
2	C(20) > Y * S(20,F)	METR PRES1	1000	0	1.01	0
3	C(22) > Y * S(22,F)	METR TEMP1	150	0	1.01	0
4	C(23) > Y * S(23,F)	METR PRES2	1000	0	1.01	0
5	C(24) > Y * S(24,F)	DIFF PRES2	100	0	1.01	0
6	C(25) > Y * S(25,F)	DIFF PRES3	100	0	1.01	0
7	C(26) > Y * S(26,F)	METR TEMP2	150	0	1.01	0
8	C(76) > Y	FLW RT		0	99999999	0
9	C(74) > Y	VOLUME		0	99999999	0
10	C(100) = 0	TS1 DISAB		0	0	0
11	C(105) = 0	TS2 DISAB		0	0	0
12	C(110) = 0	TS3 DISAB		0	0	0

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 setpoint 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 un-acknowledged 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 of 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.

13.0 DOWNLOADING ALARMS WITH HOST COMMUNICATIONS SOFTWARE (HCS)

The SolarFlow Plus software has been modified to conform to Federal Communications Commission (FCC) regulations regarding automatic telephone dialing. This will not affect any operations unless Host Communications Software (HCS) is used to perform alarm call-outs. FCC regulations require that an alarm call-out device such as SolarFlow Plus cannot call the same phone number repeatedly for the same alarm occurrence. This would happen only if an alarm were configured to use one phone number. If an alarm occurred, SolarFlow Plus would formerly dial the one phone number repeatedly until someone answered and properly acknowledged the alarm. In most applications two or more phone numbers are assigned to an alarm.

In order to comply with this FCC regulation, SolarFlow Plus will now detect when HCS downloads an Alarm/Phone Number list with only a single phone number assigned to an alarm. When this condition is detected, SolarFlow Plus erases the downloaded Alarm/Phone Number list. HCS will not detect this action. If SolarFlow Plus is contacted through HCS in the Terminal Access Mode, each alarm will read "NO ENTRY". The Alarm/Phone Number list will need to be downloaded again with at least two phone numbers assigned to an alarm at all times to conform to this FCC regulation.

HCS allows phone numbers to be active during different time periods and on various days of the week. The easiest way to comply with this FCC regulation is to make sure that the phone number list ends with two "24-hours-a day-7-days-a-week" phone numbers.

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14.0 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. Consult the manual for your Daniel PC software to determine whether it supports this feature.

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15.0 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.

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16.0 HIGH SPEED CHANNEL READS

This application supports high speed channel reads with DSI protocol.

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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 APPARÉIL 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 MINISTÉRE 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