

MODEL 2480 SOLARFLOW PLUS

**DANIEL MEASUREMENT AND CONTROL
HOUSTON, TEXAS**

"AGA-3 2480 SSNGL"

**HHDT EPROM 8-2480-149
2480 EPROM 8-2481-001**

**Part Number: 3-9004-002
Revision M**

March 1999

DANIEL

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**DANIEL INDUSTRIES, INC.
MODEL 2480 SOLARFLOW PLUS
SINGLE METER RUN AGA-3
WITH STACKED DP'S
APPLICATION MANUAL**

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SECTION 1

1.0 INTRODUCTION

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(s) for which the SolarFlow Plus is intended. The Hand Held Data Terminal (HHDT) provided with SolarFlow Plus is compatible with all applications for which the Model 2480 SolarFlow Plus is configured. This manual provides specific information on a Model 2480 SolarFlow system configured for the Model 2480, single-meter run with stacked DP's, AGA-3 application. Basic reference information on the Model 2480 SolarFlow Plus system is provided in the System Reference Manual (Daniel part number 3-9000-497). 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 2480 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 the AGA-3 single-meter run application with stacked DP transmitters
- 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 SINGLE METER RUN AGA-3 APPLICATION WITH TWO DP TRANSMITTERS

The SolarFlow Plus standard single-meter run AGA-3 application is designed for installations with a single orifice-meter tube that has two differential pressure (DP) transmitters, one static pressure transducer, and one RTD temperature input.

Figure 1-1 shows the installation configuration for the inputs in the single-meter AGA-3 Application.

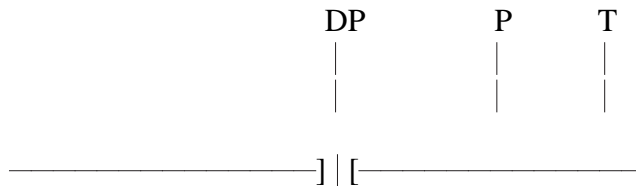


Figure 1-1. Installation Configuration for A Single-Meter AGA-3 SolarFlow Plus Application with Two Differential Pressure Transmitters

SECTION 2

2.0 AGA-3 SINGLE (AGA-3 2480 SSNGL) CALCULATION MODULE

This manual supports a SolarFlow Plus computer configured to calculate orifice-meter measurements 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.

2.1 FLOW RATE

In general, the equation for calculating flow rate is:

$$Q_h = C' \sqrt{h_w * P_f}$$

where:

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

2.2 ORIFICE FLOW CONSTANT (C')

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

$$C' = \frac{(F_b * F_{pb} * F_{tb} * F_g * F_{pv} * F_r * Y * F_{tf} * F_a)}{1000}$$

where:

- F_b = 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 72, ANSI/API 2530).
- F_{pv} = calculations are limited to adjusted pressures of 0 (zero) to 2000 pounds per square inch, gauge and adjusted temperatures of -40 to 240 degrees Fahrenheit (°F).
- 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).

2.3 WATER VAPOR FACTOR (F_w)

The format of the F_w factor is .xxxx and is available for logging purposes on Channel 62. The F_w factor may be viewed via the HHDT listed under the "DISPLAY" "FACTORS" submenu. This factor is calculated from the following formula:

$$W = \frac{e^A}{f_p} + e^B$$

where:

- W = water content LBS/MMSCF
- f_p = flowing static pressure psia
- f_t = flowing temperature degrees F
- A = K1 - [K2/(K3 + f_t)]
- B = K4 - [K5/(K6 + f_t)]
- K1 = 25.36794227
- K2 = 7170.42747964
- K3 = 389.5293906
- K4 = 15.97666211
- K5 = 7737.37631961
- K6 = 483.28778105

$$F_w = 1 - \frac{K7 * K8}{1,000,000}$$

where:

- K7 = (W -7)/18.015
- K8 = 378.61*14.73/pressure base

2.4 CALCULATION CYCLES

During normal SolarFlow Plus operation, calculations are performed continuously. Each complete set of calculations is based on a calculation cycle. The time required to complete a calculation cycle depends on processor speed and the extent of data communication required by the application calculation module.

The SolarFlow Plus computer calculates the critical part of the flow rate calculation, extension factor, $(h_w * P_f)^{.5}$, every half second. The computer calculates the factors included in the flow constant (C'), at an interval defined by the application program, typically every 15 to 25 seconds. The factors in C' that are dependent upon sampled input values use the average of the 0.5-second samples in each calculation.

For example, if an application takes 20 seconds to calculate a new C' value, a total of 40 extension factors are calculated during the C' calculation interval. In addition, 40 samples of each analog input are obtained and averaged during the same period of time. SolarFlow Plus sums up and averages the individual extension factors then multiplies the result by the latest calculated value of C' to produce an updated value for flow rate.

At the end of each flow rate calculation cycle, SolarFlow Plus updates channel values that are dependent on the calculated value of flow rate, such as flow rate, and total volume.

SECTION 3

3.0 FIELD WIRING CONNECTIONS

3.1 ANALOG INPUT CONNECTIONS

Analog inputs for the single-meter AGA-3 application of the Model 2480 SolarFlow Plus are connected in accordance with the following table.

A field wiring diagram is provided in Appendix C of the Model 2480 System Reference Manual. Drawing number DE-11284 sheet 2, in Appendix C of the Model 2480 System Reference Manual provides field wiring detail for connecting the inputs. Figure 3-1 illustrates the terminal board connections for this application.

The following table shows the SolarFlow Plus channels assigned for connecting analog inputs to the unit.

CH	TRANSMITTER TYPE	WIRE COLOR	TB2 PIN NO.	TB2 PIN LABEL
19	External low range DP transmitter, (To be installed by user.)	Blue	1	AUX
		Red	2	+12 V
		Black	3	GND
20	Daniel Model 224 millivolt static pressure transmitter, (Factory wired, if installed inside SolarFlow Plus enclosure.)	Yellow	10	PWR +
		Green	11	SIG +
		White	12	SIG -
		Black	13	PWR -
- or -				
20	Statham series 36, 1-5 VDC static pressure transmitter, (Factory wired, if installed inside SolarFlow Plus enclosure.)	Blue	7	SP
		Red	8	+12 V
		Black	9	GND
21	External, RTD temperature transducer, (To be installed by user, cable supplied with connector.)	*	14	TEMP
		#	15	GND
		#	16	GND
22	External DP transmitter, (To be installed by user.)	Blue	4	DP1
		Red	5	+12 V
		Black	6	GND

* Amber with Black tracer or Red

Amber or White

3.2 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.

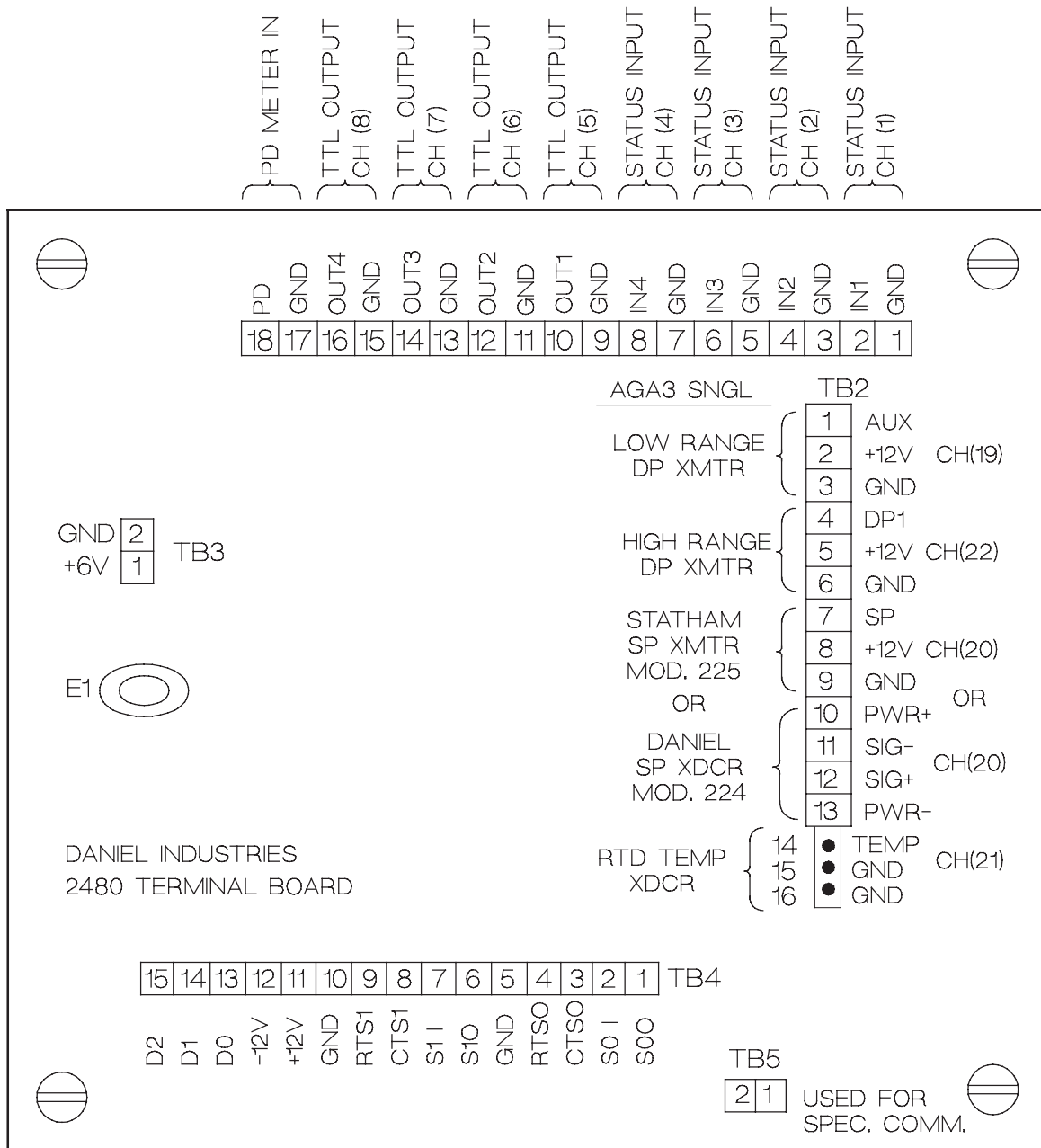


Figure 3-1. Terminal Board Connections

3.2.1 TTL LEVEL SIGNAL OUTPUTS

This application has one TTL output for corrected station volume on channel 5. The volume per pulse and the pulse period of the output may be changed using the HHDT. Prompts for changing the volume per pulse (VPP1) and pulse period (PP1) are included in the discussion of the CONFIG submenu of the SETUP UNIT menu.

TTL level output for channel FIVE (5) is available at the terminal board TB1 shown in the following table.

CH	SIGNAL DESCRIPTION	LABEL	TB1 PIN NO.	TB1 LABEL	SIGNAL TYPE
5	Volume pulse output 1	VP1	10	OUT1	TTL Output
			9	GND	Common

SECTION 4

4.0 SETUP LOCATION MENU

The SolarFlow Plus operating parameters for the single-meter run AGA-3 application that can be changed in the SETUP LOCATION menu are shown in the table below described by the HHDT prompt for the parameter, the factory-installed default value, and a blank space for entering the desired value if different from the factory default. Additional information on the SETUP LOCATION menu is provided in section 5.10.1 of the Model 2480 System Reference Manual.

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

- NOTE:**
- (1) Refer to section 5.10.1.6 in the Model 2480 System Reference Manual for a complete discussion of the SEC CODE prompt.
 - (2) Refer to section 5.10.1.7 in the Model 2480 System Reference Manual for a complete discussion of the USER REP prompt.
 - (3) Refer to section 5.10.1.8 in the Model 2480 System Reference Manual for a complete discussion of the PCOMM RATE prompt.

- (4) Refer to section 5.10.1.9 in the Model 2480 System Reference Manual for a complete discussion of the RTS DELAY prompt.

SECTION 5

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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SECTION 6

6.0 SETUP UNIT MENU

The parameters for the single-meter AGA-3 application of SolarFlow Plus that can be changed in the five submenus of the SETUP UNIT menu using the HHDT are tabulated below. 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 (0-23)	_____
LOG INTRVL	1 HR	_____
LOG DEFINE (1)		_____
RESET CMOD (2)	OFF	_____

-
- NOTE:**
- (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 section 11.3 for a description of the LOG DEFINE prompt.
 - (2) The calculations module in Model 2480 is established upon initial startup. Refer to section 5.10.2 in the System Reference Manual.
-

6.2 INPUTS SUBMENU

The INPUTS submenu of the SETUP UNIT menu of the HHDT provides for switching between LIVE and FIXED values of the following analog inputs. Refer to section 5.10.2.2 in the Model 2480 System Reference Manual for additional information.

HHDT PROMPT	DEFAULT
METR PRES	XXXXXX PSIG
METR TEMP	XXXXXX DEGF
DIFF PRESL	XXXXXX INH2O
DIFF PRES	XXXXXX INH2O

6.3 SCALES SUBMENU

The high- and low-scale setpoints for the analog inputs shown in the table below can be modified in the SCALES submenu of the SETUP UNIT menu of the HHDT. Refer to section 5.10.2.3 in the Model 2480 System Reference Manual for additional information.

HHDT PROMPT	DEFAULT		DESIRED
M PRES /LO	0	PSIG	_____
M PRES /HI	1000	PSIG	_____
M TEMP/LO	0	DEGF	_____
M TEMP/HI	150	DEGF	_____
D PRESL/LO	0	INH2O	_____
D PRESL/HI	30	INH2O	_____
D PRES/LO	0	INH2O	_____
D PRES/HI	150	INH2O	_____

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 section 5.10.2.4 in the Model 2480 System Reference Manual for additional information.

HHDT PROMPT	DEFAULT	DESIRED
PIPE DIAM	8.071 IN	_____
ORIF DIAM	4.000 IN	_____
ORIF MTRL	0	_____
		0 = STEEL 1 = MONEL
ZFLOW LIM	2.00 %	_____
ATMS PRES	14.73 PSIA	_____
PRES BASE	14.73 PSIA	_____
TEMP BASE	60 DEGF	_____
BTU CNTENT	1000.0	_____
SPEC GRAV	0.600	_____
CO2	0.00 MOL%	_____
N2	0.00 MOL%	_____
TAP LCTN	0	_____
		0 = DOWNSTREAM 1 = UPSTREAM
TAP TYPE	0	_____
		0 = FLANGE 1 = PIPE
VPP 1 ⁽¹⁾	0.1 MCF	_____
		MCF/PULSE
PP 1 ⁽²⁾	0 SEC	_____
		PULSE PERIOD
%DEV	0 %RANG	_____

- NOTE:**
- (1) VPP1 is not the same as the output on channel 5 (VP1). VP1 is a output pulse representing corrected station volume. VPP1 is a scaling factor for VP1 in thousands of cubic feet per pulse (MCF per pulse). The number of cubic feet per pulse can be modified using the HHDT. As indicated in the table, the scaling factor in MCF per pulse is 0.1. To accommodate an external totalizer that advances in increments of 1000 standard cubic feet (SCF) per pulse, the default value of VPP1 would be reset to 1 MCF per pulse.
 - (2) The pulse period can be modified using the HHDT. As indicated in the table, no pulses are generated by PP1 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 to 1 would generate a pulse 1 second in duration. The value for PP1 must be an integer equal to 1 or greater. Fractions of a second are not permitted.

6.5 FACTORS SUBMENU

The FACTORS submenu of the SETUP UNIT menu of the HHDT provides for switching between LIVE and FIXED values for the calculated factors shown in the following table. Refer to section 5.10.2.5 in the Model 2480 System Reference Manual for additional information.

HHDT PROMPT	DEFAULT
FB FCTR	XXXX
FPB FCTR	XXXX
FTB FCTR	XXXX
FG FCTR	XXXX
FPV FCTR	XXXX
FR FCTR	XXXX
Y FCTR	XXXX
FTF FCTR	XXXX
FA FCTR	XXXX
FW FCTR	XXXX

SECTION 7**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, SCALES, RATE/VOLS, CONFIG, and FACTORS.

INPUTS

- BATTERY
- METR PRES
- METR TEMP
- DIFF PRESL
- DIFF PRES

SCALES

- M PRES /LO
- M PRES /HI
- M TEMP/LO
- M TEMP/HI
- D PRESL/LO
- D PRESL/HI
- D PRES/LO
- D PRES/HI

RATE/VOLS

- FLOW RATE
- TOT VOL
- TODAY VOL
- YSDAY VOL
- MMBTU RATE
- TOT ENERGY
- TDY ENERGY
- YSY ENERGY
- VP1
- PC1
- UVOL 1Y
- UVOL 1H

CONFIG

PIPE DIAM
ORIF DIAM
ORIF MTRL
ZFLOW LIM
ATMS PRES
PRES BASE
TEMP BASE
BTU CNTENT
SPEC GRAV
CO2
N2
TAP LCTN
TAP TYPE
VPP 1
PP 1
%DEV

FACTORS

FB FCTR
FPB FCTR
FTB FCTR
FG FCTR
FPV FCTR
FR FCTR
Y FCTR
FTF FCTR
FA FCTR
FW FCTR

FLW AVERAGES

AVG PRES Y
FLW DIFF Y
AVG TEMP Y
AVG PRES H
FLW DIFF H
AVG TEMP H

MAX/MINIMUMS

PRES MIN
PRES MAX
FRT MIN
FRT MAX
DIFF MIN
DIF MAX

INTEGRATOR EXT

PRES EXT H
FLOW EXT H
TIME IDX H
FLW TEMP H
PRES EXT Y
FLOW EXT Y
TIME IDX Y
FLW TEMP Y

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SECTION 8**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 section 5.11 in the Model 2480 System Reference Manual for additional information.

8.1 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 PRES
DIFF PRESL
DIFF PRES

8.2 OTHERS

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

METR TEMP

This page intentionally left blank.

SECTION 9**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. These analog inputs listed below are available in the MONITOR menu in the single-meter AGA-3 application. Refer to section 5.13.8 in the Model 2480 System Reference Manual for additional information.

METR PRES
METR TEMP
DIFF PRESL
DIFF PRES

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SECTION 10

10.0 AGA-3 2480 STACKED SINGLE CHANNEL ASSIGNMENTS

10.1 USER REPORT (CHANNEL ZERO)

The SolarFlow Plus has a front panel display that provides a predefined report list. The report list contains the channel data shown in the table below and is displayed in a scrolling format.

The list is factory defined for the application and is not changeable by the user.

CHANNEL NUMBER	CHANNEL LABEL	DESCRIPTION
23	BATTERY	Battery voltage
20	METR PRES	Pressure in PSIG
21	METR TEMP	Temperature in DEG F
29	COMP DPRES	Composite DP in INH2O
55	FLOW RATE	Flow rate in MCF/HR
53	TOT VOL	Total volume in MCF
56	TODAY VOL	Today's volume in MCF
57	YSDAY VOL	Yesterday's volume in MCF

10.2 CHANNEL ONE THROUGH 18 ASSIGNMENTS

Assignments for the single meter AGA-3 application channels one through 18 are tabulated as follows.

CH	LABEL	INPUT/OUTPUT	0-LABEL	1-LABEL	DEFAULT	DESCRIPTION
001 through 004 are reserved for later use						
5	VP1	OUT	OFF	ON	OFF	Volume Pulse output 1
006 through 008 are reserved for later use						
009 through 018 are unavailable						

10.3 CHANNEL 19 THROUGH 105 ASSIGNMENTS

Assignments for the single meter run AGA-3 channels 19 through 105 are tabulated as follows. The column labeled DP in the table indicates the number of points displayed/logged past the decimal point.

CH	REF	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
19	H _w	DIFF PRESL	INH2O	1	--	Low range DP transmitter Scale 0-30.0
20	P _f	METR PRES	PSIG	0	--	Meter 1 flowing pressure Scale 0-1000
21	T _f	METR TEMP	DEG F	0	--	Scale 0-150
22	H _w	DIFF PRES	IN H2O	1	--	High range DP transmitter Scale 0-150.0
23		BATTERY	VOLTS	2	--	Battery voltage Scale 2.43-12.1 VDC
Channels 24 through 28 are unavailable.						
29		COMP DPRES	INH2O	1	--	Composite DP
30	D	PIPE DIAM	IN	3	8.071	Pipe diameter
31	d	ORIF DIAM	IN	3	4.000	Orifice diameter
32	P _a	ATMS PRES	PSIA	2	14.73	Atmospheric pressure
33	P _b	PRES BASE	PSIA	2	14.73	Pressure base
34	T _b	TEMP BASE	DEG F	0	60	Temperature base
35	G	SPEC GRAV	(None)	3	0.600	Specific gravity
36		CO2	MOL%	2	0.00	Carbon dioxide inert for Fpv calculation
37		N2	MOL%	2	0.00	Nitrogen inert for Fpv calculation
38		TAP LCTN	(None)	0	0	Tap location: Downstream = 0 Upstream = 1

CH	REF	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
39		TAP TYPE	(None)	0	0	Tap type: Flange = 0 Pipe = 1
40	F _b	FB FCTR	(None)	1	1.0	Orifice factor
41	F _{pb}	FPB FCTR	(None)	4	1.0000	Pressure base factor
42	F _{tb}	FTB FCTR	(None)	4	1.0000	Temperature base factor
43	F _g	FG FCTR	(None)	4	1.0000	Gravity factor
44	F _{pv}	FPV FCTR	(None)	4	1.0000	Supercompressibility factor
45		FPV MTHD	(None)	0	0	Fpv Calculation Method 0 = Standard 1 = Alternate
46		PADJ FCTR	(None)	3	0.000	NX-19 pressure adjustment factor
47		TADJ FCTR	(None)	3	0.000	NX-19 temperature adjustment factor
48	F _r	FR FCTR	(None)	4	1.0000	Reynolds number factor
49	Y	Y FCTR	(None)	4	1.0000	Expansion factor
50	F _{tf}	FTF FCTR	(None)	4	1.0000	Flowing temperature factor
51	F _a	FA FCTR	(None)	4	1.0000	Thermal expansion factor
52		ORIF MTRL	(None)	0	0	Orifice material: 0 = steel 1 = monel
53		TOT VOL	MCF	1	0.0	Total accumulated volume
54		LOG VOL	MCF	1	0.0	Logged accumulated volume
55		FLOW RATE	MCF/HR	1	0.0	Flow rate

CH	REF	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
56		TODAY VOL	MCF	1	0.0	Today's volume
57		YSDAY VOL	MCF	1	0.0	Yesterday's volume
58		ZFLOW LIM	%	2	2.00	Low flow cutoff limit
59		VPP 1	MCF	1	0.100	Volume per pulse 1
60		PP 1	SEC	1	0.0	Pulse period 1
61		PC 1	(None)	0	0	Total pulses 1
62	F _w	Fw FCTR	(None)	4	0.0000	Water vapor factor
63		AVG PRES Y	PSIG	0	0	Average pressure last day
64		FLW DIFF Y	INH2O	1	0.0	Average flowing differential last day
65		AVG TEMP Y	DEG F	0	0	Average temperature last day
66		U VOL 1Y	CU FT	1	0.0	Uncorrected volume last day
67		AVG PRES H	PSIG	0	0	Average pressure last hour
68		FLW DIFF H	INH2O	1	0.0	Average flowing differential last hour
69		AVG TEMP H	DEG F	0	0	Average temperature last hour
70		U VOL 1H	CU FT	1	0.0	Uncorrected volume last hour
71		PRES MIN	PSIG	0	0	Minimum pressure this log interval
72		FRT MIN	MCFH	1	0.0	Minimum flowrate this log interval
73		DIFF MIN	INH2O	1	0.0	Minimum differential pressure this log interval
74		PRES MAX	PSIG	0	0	Maximum pressure this log interval

CH	REF	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
75		FRT MAX	MCFH	1	0.0	Maximum flowrate this log interval
76		DIFF MAX	INH2O	1	0.0	Maximum differential pressure this log interval
77		PRES EXT H	(None)	0	--	Pressure extension last hour
78		FLOW EXT H	(None)	0	--	Flow extension last hour
79		TIME IDX H		0	--	Flow time index last hour

NOTE: The equations used to calculate the functions of channels 77, 78 and 79 are shown as follows.

$$CH\# 77 = PRES \ EXT \ H = 100 * \sum \left(\frac{PF * 100}{RANGE} \right) * \frac{SAMPLE}{3600}$$

$$CH\# 78 = FLOW \ EXT \ H = 100 * \sum \sqrt{\left(\frac{PF * 100}{RANGE} * \frac{DP * 100}{RANGE} \right)} * \frac{SAMPLE}{3600}$$

$$CH\# 79 = TIME \ IDX \ H = 1000 * \sum \left(\frac{SAMPLE}{3600} \right)$$

where:

- SAMPLE = sampling interval in seconds
- RANGE = calibrated range of the transducer
- PF = static pressure (PSIA)
- DP = differential pressure in inches of water

CH	REF	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
80		FLW TEMP H	DEGF	0	--	Average flowing temperature last hour
81		PRES EXT Y	(None)	0	--	Pressure extension last day
82		FLOW EXT Y	(None)	0	--	Flow extension last day
83		TIME IDX Y	(None)	0	--	Flow time index last day
84		FLW TEMP Y	(None)	0	--	Average flowing temperature last day
85		FLW PRES H	PSIG	0	--	Average flowing pressure last hour
86		FLW PRES Y	PSIG	0	--	Average flowing pressure yesterday
87		FLW TIME H	MIN	0	--	Flow time last hour
88		FLW TIME Y	MIN	0	--	Flow time yesterday
89 Reserved						
90		% DEV	%RANG	0	0	0=Normal under/over range fault bits; see section 12.2.1
91-99 Reserved						
100		BTU CNTENT		1	1000.0	BTU content of gas in BTU/MCF
101		TOT ENERGY	MMBTU	1	0.0	Accumulated energy total (Rolls over @ 10,000,000)
102		LOG ENERGY	MMBTU	1	0.0	Logged energy
103		MMBTU RATE	/HR	1	0.0	Energy flow rate
104		TDY ENERGY	MMBTU	1	0.0	Accumulated daily energy since contract hour
105		YSY ENERGY	MMBTU	1	0.0	Yesterday's accumulated energy

SECTION 11

11.0 DATA LOG LIST AND HEADER BLOCK

11.1 DATA LOG LIST CONTENTS

The AGA-3 single meter application has one data log list, which is set to a one-hour interval with a contract hour at 7:00 AM. The following items are included on the data log.

CHANNEL NUMBER	CHANNEL LABEL	DECIMAL PLACES	DIGITS	LOGGING TYPE
21	METR TEMP	0	4	Average
20	METR PRES	0	6	Average
22	DIFF PRES	1	4	Average
54	LOG VOL	1	8	Snapshot and Zero
56	TODAY VOL	1	8	Snapshot
57	YSDAY VOL	1	8	Snapshot

11.2 DATA LOG HEADER BLOCK CONTENTS

M PRES/LO
M PRES/HI
M TEMP/LO
M TEMP/HI
D PRES/LO
D PRES/HI
D PRES/LO
D PRES/HI
PIPE DIAM1
ORIF DIAM1
ORIF MTRL
ZFLOWLIM
ATMS PRES
PRES BASE
TEMP BASE

BTU CNTENT
FIXED SG
FIXED CO2
FIXED N2
TAP LCTN
TAP TYPE
%DEV

11.3 LOG DEFINE PROMPT

A maximum of ten items can be included in a data log. The up and down arrow keys scroll through the list of items. The insert and delete keys are also active.

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
- 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.

*If your HHDT application uses the five-digit ChTLD prompt, do not use the leading zero (channel numbers must be two digits only).

NOTE: When a change is made to the LOG DEFINE sub-menu, previously recorded data logs are automatically erased and are no longer available for retrieval. For this reason, all data logs stored in SolarFlow Plus must be collected before making changes in the LOG DEFINE sub-menu.

SECTION 12

12.0 ALARM DEFINITIONS

The following is a listing of the Alarm definitions for the AGA-3 Single meter run application.

NOTE: When using the HHDT in the ALARMS menu to set-up alarm conditions, the HHDT displays the terms "LOW", "HIGH", and "ALT". The parameter that is modified by the operator is ALT, which is equivalent to the "Z" value shown in the following alarm conditions list. The values for LOW and HIGH are not applicable to this application. Any values displayed under these prompts are meaningless. If the user desires to change a setpoint for a specific alarm, the ALT parameter is the only parameter applicable.

The number of retries for the alarms are:

- 5 for alarms 1 through 13
- 0 for alarm 14

ALARM #	ALARM CONDITION	VARIABLE VALUES		ALARM MESSAGES
		F	Z ALT	
1	C(19)<Z*S(19,F)		0	AUX LOW
2	C(19)>Z*S(19,F)		1.01	AUX HIGH
3	C(20)<Z*S(20,F)	1000	0	PRES LOW
4	C(20)>Z*S(20,F)	1000	1.01	PRES HIGH
5	C(21)<Z*S(21,F)	150	0	TEMP LOW
6	C(21)>Z*S(21,F)	150	1.01	TEMP HIGH
7	C(22)<Z*S(22,F)	150.0	0	DIFF LOW
8	C(22)>Z*S(22,F)	150.0	1.01	DIFF HIGH
9	C(55)<Z		0	FLOW LOW
10	C(55)>Z		999999.0	FLOW HIGH
11	C(53)<Z		0	VOL LOW
12	C(53)>Z		999999.0	VOL HIGH
13	BATT < 5.976*			BATT LOW
14				SYS FAIL

* This battery alarm is fixed at 5.976 VDC and cannot be changed.

12.1 CALCULATING ALARM SETPOINTS

Alarm setpoints are calculated using the equation shown under the Alarm Condition column in the table shown above. For example, to calculate the setpoint for Alarm #4, the equation shown is:

$$\text{Setpoint} = Z * S(20,F)$$

where:

$$Z = 1.01$$

$$F = 1000$$

$S(20,F) =$ The full scale value for channel 20, which is the meter pressure transmitter. The Model 2480 automatically generates this value based on the full scale value entered in the SETUP UNIT menu.

therefore:

$$\text{The setpoint for Alarm \#4 is} = 1.01 * 1000 = 1010.0$$

When the ALARM menu is entered using the HHDT the user may modify the Z value shown in the above alarm conditions by changing the value for ALT. This enables the user to adjust the alarm limit to match the requirements.

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 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.

12.2 OTHER SYSTEM CONDITIONS

There are system conditions, not strictly alarms, that will show up on the data log of the SolarFlow Plus. These system conditions may or may not require corrective action. A typical data log from the Model 2480 will be in the format shown as follows.

```

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

The print-out will list each log along with the respective date and time of the log followed by a series of parameters which were defined to be included in the data log. In addition to the defined items three other sets of data are supplied with each log interval. On the line after the Date and Time, three labels are defined as follows:

- a. U-Range which will list any of the analog inputs that were in an Under-Range condition any time during the log interval.
- b. O-Range which will list any of the analog inputs that were in an Over-Range condition any time during the log interval.
- c. Misc. which will list system conditions that have occurred during the log interval.

A series of eight decimal points (.....) are shown under the respective data log interval Date and Time. If none of the analog inputs were in an under or over range condition, decimal points will be displayed. If any of the factory defined analog inputs are out of range, a number will replace one of the decimal points. For example, if Channels 20 and 21 were Under Range the following would be displayed.

```

Date      Time
U-Range   O-Range

MM/DD/YY  HH:MM
.23.....  .....
    
```

The "2" replacing the second decimal point indicates channel 20 is Under-Range. The "3" in place of the third decimal point indicates channel 21 is Under-Range and so-on. This same sequence applies to the Over-Range conditions.

The following table lists the applicable analog input for each of the decimal points under the "U-Range" and "O-Range" identifiers.

AGA-3 2480 SSNGL		
REVISION 1.0 OR LATER SOFTWARE DECIMAL POINT	EARLY SOFTWARE DECIMAL POINT	ANALOG INPUT
1	-	Not Used, Channel 19
2	1	Meter pressure, Channel 20
3	2	Meter temperature, Channel 21
4	3	Differential pressure, Channel 22
5	4	Battery, Channel 23
6-8	5-8	Not Used

The "Misc." section is applicable for system conditions that were present during the log interval. The conditions defined as "1" through "8" are detailed as follows:

- 1 - Calibration over-deviation
- 2 - F_{pv} adjusted pressure out of range
- 3 - F_{pv} adjusted temperature out of range
- 4 - not used
- 5 - Designates daily log
- 6 - Warm start was enacted during interval
- 7 - Cold start was enacted during interval
- 8 - System fault

12.2.1 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 labelled "under-range" indicates under or over range and the item labelled "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.

SECTION 13**13.0 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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SECTION 14

14.0 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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SECTION 15

15.0 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.

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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

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