

# MODEL 2480 SOLARFLOW PLUS

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**DANIEL MEASUREMENT AND CONTROL  
HOUSTON, TEXAS**

**METRIC SINGLE METER RUN AGA-7**

**APPLICATION MANUAL**

**HHDT EPROM 8-2480-150  
2480 EPROM 8-2482-004**

**Part Number 3-9004-005  
Revision C**

**JULY 1999**

***DANIEL***

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**DANIEL INDUSTRIES, INC.  
MODEL 2480 SOLARFLOW PLUS  
METRIC SINGLE METER RUN AGA-7  
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 for which the SolarFlow Plus is intended. The Hand Held Data Terminal (HHDT) provided with SolarFlow Plus is compatible with all Model 2480 standard applications. This manual provides specific information on a Model 2480 SolarFlow system configured for the Model 2480, metric single-meter run AGA-7 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. Daniel Model 1882 Preamplifier may be of particular interest to AGA-7 users. Daniel Model 1882, mounted separately from the Model 2480, is a low power preamplifier that enables a higher pulse input (up to five KHz). Refer to section 13 for additional information. 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 metric AGA-7 single-meter run application
- 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 AGA-7 SINGLE TURBINE/PD "AGA-7 2480 MET" APPLICATION**

The AGA-7 standard applies to situations where gas volume must be corrected for pressure (Boyle's Law) and temperature (Charles' Law). It also includes factors to correct for a temperature base change, a pressure base change, and the non-ideal variation in volume (supercompressibility).

In an AGA-7 application, a volume measuring device (usually a meter of the positive displacement type) produces a series of pulses, a certain number of which represents an "uncorrected" volume of gas ( $V_u$ ). This uncorrected volume is used to calculate corrected (or standard) volume using the equation provided in section 2.

**SECTION 2**

**2.0 AGA-7 SINGLE TURBINE/PD "AGA-7 2480 MET" CALCULATION MODULE**

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

$$V_c = C' * V_u$$

Where:

- $V_c$  = corrected volume in thousands of cubic feet (MCF)
- $V_u$  = PC/M = uncorrected volume
- $C'$  = flow constant determined from:

$$((P_f + P_a)/P_b) * ((T_b + 460)/(T_f + 460)) * F_{pv}^2$$

Where:

- PC = pulse count
- M = meter factor in pulses/actual cubic meter
- $P_f$  = flowing pressure in psig\*\*
- $P_a$  = atmospheric pressure in psia\*\*
- $T_b$  = temperature base in degrees Fahrenheit (°F)\*\*
- $F_{pv}$  = NX-19 supercompressibility factor
- $T_f$  = flowing temperature in °F\*\*

\*\* Leave in English units; these values are obtained from applying conversions to the metric SolarFlow Plus channel values.

The format of the Water Vapor Factor( $F_w$ ) is .xxxx and is available for logging purposes on Channel 59. The  $F_w$  factor may be viewed via the HHDT listed under the "DISPLAY" "FACTORS" submenu. The equation for calculating Water Vapor Factor( $F_w$ ) is:

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

where:

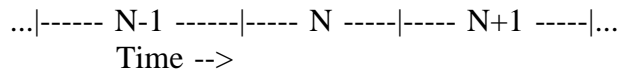
- W = water content LBS/MMSCF
- $f_p$  = flowing static pressure psia
- $f_t$  = flowing temperature degrees F
- A =  $K1 - [K2/(K3 + f_t)]$
- B =  $K4 - [K5/(K6 + f_t)]$
- K1 = 25.36794227
- K2 = 7170.42747964
- K3 = 389.5293906
- K4 = 15.97666211
- K5 = 7737.37631961
- K6 = 483.28778105

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

where:

- K7 =  $(W - 7)/18.015$
- K8 =  $378.61 * 14.73 / \text{pressure base}$

During normal operations, calculations are performed continuously. Each complete set of calculations is called a calculation cycle. The diagram below illustrates a series of calculation cycles.



The time required to complete a calculation cycle depends on processor speed and the extent of data communication with the calculation module.

At the beginning of calculation cycle N, the following data pertaining to the previous calculation cycle (N-1) is available:

1. Average static pressure and temperature for each meter run based on 1/2-second samples.
2. A non-zero pulse count.

During calculation cycle N, SolarFlow Plus calculates a flow constant based on static pressure and temperature. If a no-flow condition exists prior to calculation cycle N-1, SolarFlow Plus calculates the flow constant based on current (not average) pressure and temperature values. When flow is established, corrected volume is calculated by applying the flow constant and meter factor from calculation cycle N-1. The averages and the pulse count accumulated during calculation cycle N are available for calculations during cycle N+1.

Flow rate is determined from a ring buffer that maintains a record of the pulse count for each 1/2 second during the previous 60 seconds. A variable time window of 5 to 60 seconds provides for a minimum pulse count of 59. Flow rate calculations are based on the number of pulses, the elapsed time, and the most recent flow constant. During periods when no pulses occur, SolarFlow Plus continues to calculate flow rate at 5-second intervals. A zero flow rate results whenever less than 60 pulses are received during any 60-second period.

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**SECTION 3**

**3.0 FIELD WIRING CONNECTIONS**

**3.1 INPUT CONNECTIONS**

**3.1.1 ANALOG INPUT CONNECTIONS**

Analog inputs for the single-meter AGA-7 application of the Model 2480 SolarFlow Plus are connected in accordance with the following table.

The following table shows the SOLARFLOW PLUS channels assigned for connecting analog inputs to the unit. Drawing number DE-11284 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.

CH	TRANSMITTER TYPE	WIRE COLOR	TB2 PIN NO.	TB2 PIN LABEL
19	Auxiliary 1-5 VDC single ended analog input. Used for logging purposes only. Refer to section 12.2.1.	%	1	AUX
		%	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, Specific gravity transmitter, (To be installed by user.)	%	4	DP1
		%	6	GND

% Interconnect wiring to be supplied by user

\* Amber with Black tracer or Red

# Amber or White

---

**NOTE:** If the specific gravity input is FIXED rather than LIVE, digital channel No.1 should be held at ground level (0 volts) by installing a jumper wire between pins 1 and 2 of TB1 on the rear termination board of the Model 2480 SolarFlow Plus. The value for the specific gravity input is entered in the CONFIG submenu of the SETUP UNIT menu by keying in the desired value for the parameter, FIXED SG.

---

### 3.1.2 PD/TURBINE METER INPUT CONNECTIONS

INPUT DESCRIPTION	WIRE COLOR	TB1 PIN NO.	TB1 PIN LABEL
PD/Turbine Meter, maximum frequency of 50 Hz.*	% %	17 18	GND PD

% Interconnect wiring to be supplied by user.

\* For pulse inputs up to a maximum frequency of 5 KHz, see section 13 for information on the Model 1882.

### 3.1.3 STATUS INPUT CONNECTIONS

This application supports one status input that is activated by means of a dry contact closure between the status input channel and common. When TB1 pins 1 and 2 are connected together (shorted), a FIXED specific gravity will be used. When pins 1 and 2 are not connected (open), a live specific gravity will be used. The following details the pin-out arrangement for the status input.

CH NO.	DESCRIPTION	LABEL	TB1 PIN NO.	TB1 PIN LABEL	SIGNAL TYPE
1	Fixed SG option	FIXED	2 1	IN 1 GND	Status in Common

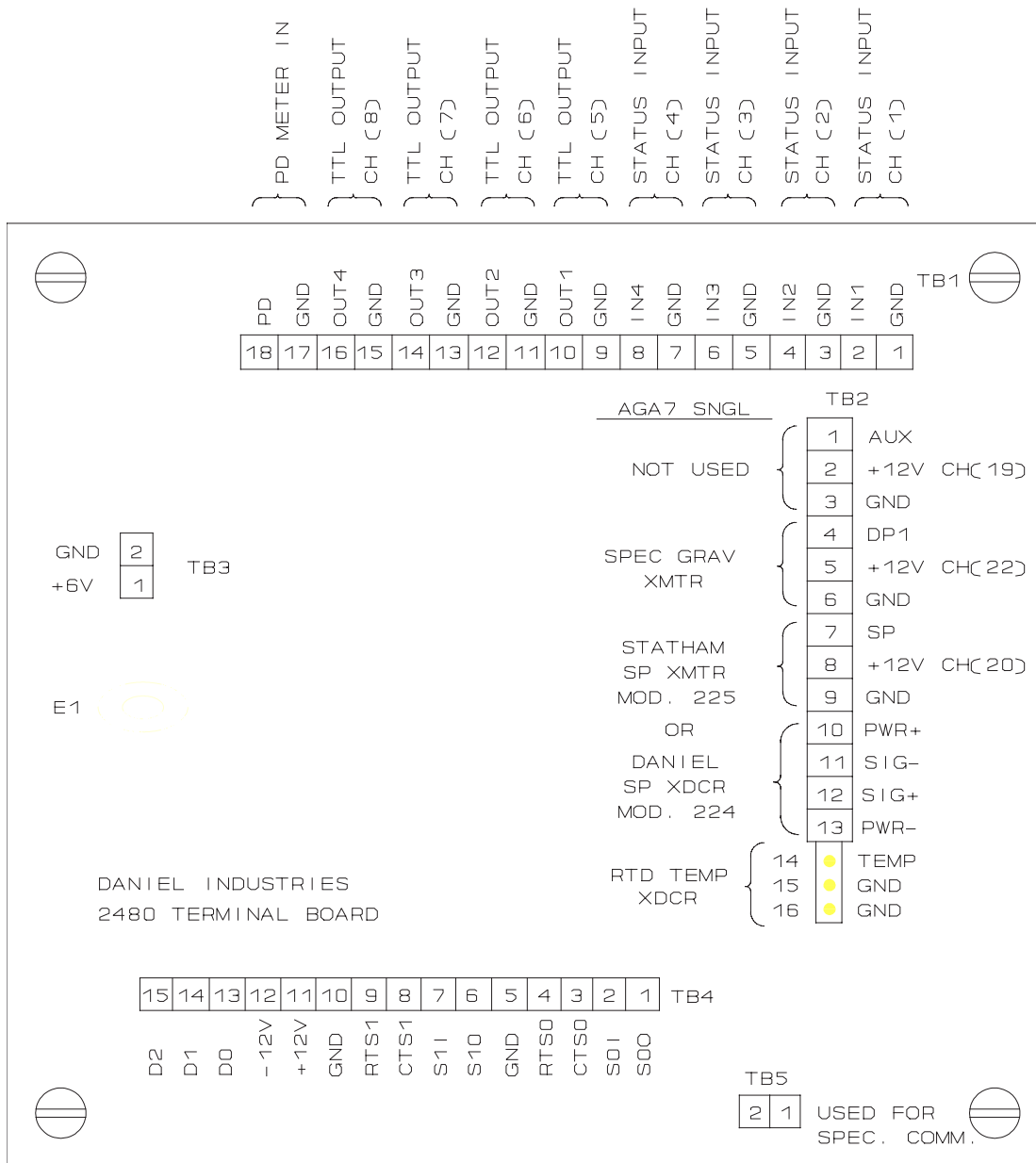


Figure 3-1. Terminal Board Connections

**3.2 OUTPUT SIGNAL CONNECTIONS**


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**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 one TTL level output that provides a digital 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.

**3.2.1 TTL LEVEL SIGNAL OUTPUT**

TTL level output for channel 5 is available at the termination board pin numbers shown in the following table.

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

**SECTION 4**

**4.0 SETUP LOCATION MENU**

The SolarFlow Plus operating parameters for the single-meter run AGA-7 application that can be changed in the SETUP LOCATION menu are shown in the following table described by the HHDT prompt for the parameter, the factory-installed default value, and a blank space for entering the desired value if different from the factory default. Additional information on the SETUP LOCATION menu is provided in section 5.10.1 of the Model 2480 System Reference Manual.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>	<b>DESIRED</b>
LOC NAME	BLANK LOCATION	_____
LOC ID	0	_____
DATE	010180 MMDDYY	_____
WEEK DAY	1 (1-7)	_____
TIME	0000 HHMM	_____
SEC CODE <sup>(1)</sup>	120	No entry allowed
USER REP <sup>(2)</sup>	*****	_____
PCOMM RATE <sup>(3)</sup>	300 BPS	_____
RTS DELAY <sup>(4)</sup>	20 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-7 (AGA-7 2480 MET) application of SolarFlow Plus that can be changed in the five 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.

<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 HR	_____
LOG DEFINE <sup>(1)</sup>		_____
RESET CMOD <sup>(2)</sup>	OFF	_____

- 
- NOTE:**
- (1) Before making changes in the LOG DEFINE Submenu, collect all data logs in SolarFlow Plus memory. Any time a change is made in the LOG DEFINE menu, all data logs in SolarFlow Plus memory are automatically erased and cannot be recovered. Refer to section 11.3 for a description of the LOG DEFINE prompt.
  - (2) The RESET CMOD (Reset Calculations Module) prompt performs no function in Model 2480 SolarFlow Plus. It is used in Models 2460 and 2470 to change to another application when necessary. 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 analog inputs shown as follows. Refer to section 5.10.2.2 in the Model 2480 System Reference Manual for additional information.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>
METR PRES	XXXXX KPa
METR TEMP	XXXXX DEGC
LIVE SG	XXXXX

**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 section 5.10.2.3 in the Model 2480 System Reference Manual for additional information.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>	<b>DESIRED</b>
M PRES /LO	0 KPa	_____
M PRES /HI	6900 KPa	_____
M TEMP /LO	-18 DEGC	_____
M TEMP /HI	66 DEGC	_____
LIVE SG/LO	0.6	_____
LIVE SG/HI	0.8	_____

**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.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>		<b>DESIRED</b>
ATMS PRES	101.325	KPa	_____
PRES BASE	101.325	KPa	_____
TEMP BASE	15	DEGC	_____
FIXED SG	0.600		_____
CO2	0.00	MOL%	_____
N2	0.00	MOL%	_____
VPP 1 <sup>(1)</sup>	10	M <sup>3</sup>	_____
		M <sup>3</sup> /PULSE	_____
PP 1 <sup>(2)</sup>	0	SEC	_____
		PULSE PERIOD	_____
ZFLOW LIM	300	SEC	_____
%DEV	0	%RANG	_____
PK CONFIG	0		_____

- 
- 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 cubic meters per pulse ( $M^3$  per pulse). The number of cubic meters per pulse can be modified using the HHDT. As indicated in the table, the scaling factor in  $M^3$  per pulse is 10.
  
  - (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 entering the meter factor in pulses per actual cubic foot. In addition it 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.

<b>HHDT PROMPT</b>	<b>DEFAULT</b>	<b>DESIRED</b>
METR FCTR	1000.000	_____ Pulses/AM <sup>3</sup>
FPV 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
- LIVE SG

#### SCALES

- M PRES /LO
- M PRES /HI
- M TEMP /LO
- M TEMP /HI
- LIVE SG/LO
- LIVE SG/HI

#### RATE/VOLS

- FLOW RATE
- TOT UC VOL
- TOT C VOL
- TODAY VOL
- YSDAY VOL
- VP1
- PC1
- U VOL 1Y
- U VOL 1H
- PK CONFIG
- PK RESET
- PK HR VOL
- PK HR TIME
- PK DY VOL
- PK DY TIME

CONFIG

ATMS PRES  
PRES BASE  
TEMP BASE  
FIXED SG  
CO2  
N2  
VPP 1  
PP 1  
ZFLOW LIM  
%DEV  
PK CONFIG

FACTORS

METR FCTR  
FPV FCTR  
FW FCTR

FLW AVERAGES

AVG PRS Y  
AVG TEMP Y  
AVG PRES H  
AVG TEMP H

MAX/MINIMUMS

PRES MIN  
PRES MAX  
FRT MIN  
FRT MAX



INTEGRATOR EXT  
AV FL SP H  
AVG SP H  
TIME IDX H  
FLW TEMP H  
FLW PRES H  
AV FL SP Y  
AVG SP Y  
TIME IDX Y  
FLW TEMP Y  
FLW PRES Y  
FLW TIME H  
FLW TIME 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.

METR PRES

#### **8.2 OTHERS**

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

METR TEMP  
LIVE SG

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## 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. This analog inputs listed below are available in the MONITOR menu in the single-meter AGA-7 application. Refer to section 5.13.8 in the Model 2480 System Reference Manual for additional information.

METR PRES  
METR TEMP  
LIVE SG

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**SECTION 10**

**10.0 AGA-7 SINGLE STANDARD CHANNEL ASSIGNMENTS**

**10.1 USER REPORT (CHANNEL ZERO)**

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

<b>CHANNEL NUMBER</b>	<b>CHANNEL LABEL</b>	<b>DESCRIPTION</b>
23	BATTERY	Battery voltage
20	METR PRES	Flowing pressure
21	METR TEMP	Flowing temperature
*22	LIVE SG	Specific gravity
55	FLOW RATE	Current flow rate in cubic meters per hour (M <sup>3</sup> /HR)
51	TOT UC VOL	Total uncorrected volume in cubic meters (M <sup>3</sup> )
53	TOT C VOL	Total corrected volume in cubic meters (M <sup>3</sup> )
56	TODAY VOL	Today's volume in cubic meters (M <sup>3</sup> )
57	YSDAY VOL	Yesterday's volume in cubic meters (M <sup>3</sup> )
83	PK HR VOL	Corrected volume accumulated during hour of peak flow
84	PK HR TIM	Date/time stamp of the PK HR VOL
85	PK DY VOL	Corrected volume accumulated during the day of peak flow
86	PK DY TIM	Date/time stamp of the PK DY VOL

\* This entry will be skipped if it is configured to use fixed gravity.

**10.2 CHANNEL ONE THROUGH 18 ASSIGNMENTS**

Assignments for the single meter AGA-7 application channels one through 18 are tabulated as follows:

CH	LABEL	INPUT/ OUTPUT	0- LABEL	1- LABEL	DEFAULT	DESCRIPTION
*1	Fixed	Inp	YES	NO	--	Fixed gravity in use
2	PK Reset	Inp	YES	NO		YES=reset peak vol/date/time stamp
003 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						

- \* 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 a fixed or live specific gravity value 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 90 ASSIGNMENTS**

Assignments for the single meter run AGA-7 channels 19 through 90 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
Channels 1 through 19 are reserved for later use.						
19 Reserved for later use						
20	P <sub>f</sub>	METR PRES	KPa	1	--	Meter 1 flowing pressure Scale 0-6900
21	T <sub>f</sub>	METR TEMP	DEG C	1	--	Scale -18-66
22		LIVE SG		3	--	Scale 0.600 - 0.800
23		BATTERY	VOLTS	2	--	Battery voltage Scale 2.42-12.12 VDC
Channels 24 through 31 are unavailable.						
32	P <sub>a</sub>	ATMS PRES	KPa	3	101.325	Atmospheric pressure
33	P <sub>b</sub>	PRES BASE	KPa	3	101.325	Pressure base
34	T <sub>b</sub>	TEMP BASE	DEG C	0	15	Temperature base
35	G	SPEC GRAV	(None)	3	0.600	Fixed 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 - 42 are not used						
43		METR FCTR		2	1000.00	Meter factor in pulse/M <sup>3</sup>
44	F <sub>pv</sub>	FPV FCTR	(None)	4	1.0000	Meter supercompressibility factor

CH	REF	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
45		FPV MTHD	(None)	0	0	FPV calculation method: 0= standard, 1= alternate
46		PADJ FCTR	(None)	3	0.000	NX-19 pressure adjusting factor
47		TADJ FCTR	(None)	3	0.000	NX-19 temperature adjusting factor
48		VPP 1	M <sup>3</sup>	1	0.100	Volume per pulse
49		PP 1	SEC	0	0	Pulse period
50		PC 1	(None)	0	0.0	Total pulses
51		TOT UVOL	M <sup>3</sup>	1	0.0	Total uncorrected volume
52		LOG UVOL	M <sup>3</sup>	1	0.0	Logged uncorrected volume
53	V <sub>c</sub>	TOT CVOL	M <sup>3</sup>	1	0.0	Total corrected volume
54		LOG CVOL	M <sup>3</sup>	1	0.0	Logged corrected volume
55	Q <sub>c</sub>	FLOW RATE	M <sup>3</sup> /HR	1	0.0	Current flow rate
56		TODAY VOL	M <sup>3</sup>	1	0.0	Today's volume
57		YSDAY VOL	M <sup>3</sup>	1	0.0	Yesterday's volume
58		ZFLOW LIM	SEC	0	300	Low flow cutoff limit
59	F <sub>w</sub>	Fw FCTR	(None)	4	0.0000	Water vapor factor
60		AVG PRES Y	KPa	0	0	Average flowing pressure last day
61		AVG TEMP Y	DEG C	0	0	Average flowing temperature last day
62		U VOL 1Y	M <sup>3</sup>	1	0.0	Uncorrected volume last day

CH	REF	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
63		AVG PRES H	KPa	0	0	Average flowing pressure last hour
64		AVG TEMP H	DEG C	0	0	Average flowing temperature last hour
65		U VOL 1H	M <sup>3</sup>	1	0.0	Uncorrected volume last hour
66		PRES MIN	KPa	0	0	Minimum pressure this log interval
67		FRT MIN	M <sup>3</sup> /HR	1	0.0	Minimum flowrate this log interval
68		PRES MAX	KPa	0	0	Maximum pressure this log interval
69		FRT MAX	M <sup>3</sup> /HR	1	0.0	Maximum flowrate this log interval
70		AV FL SP H	KPa	1	0.0	Hourly average flowing static pressure (pres extension)
71		AVG SP H	KPa	1	0.0	Hourly average static pressure
72		TIME IDX H	(None)	1	0.0	Hourly flow time index
73		FLW TEMP H	DEG C	1	0.0	Hourly average flowing temperature
74		FLW PRES H	KPa	1	0.0	Hourly average flowing pressure
75		AV FL SP Y	KPa	1	0.0	Daily average flowing static pressure (pres extension)
76		AVG SP Y	KPa	1	0.0	Daily average static pressure
77		TIME IDX Y	(None)	1	0.0	Daily flow time index

CH	REF	LABEL	UNITS	DP	DEFAULT	DESCRIPTION
78		FLW TEMP Y	DEG C	1	0.0	Daily average flowing temperature
79		FLW PRES Y	KPa	1	0.0	Daily average flowing pressure
80		FLW TIME H	MIN	1	0.0	Hourly flow time (minutes)
81		FLW TIME Y	MIN	2	0.0	Daily flow time (minutes)
82		PK CONFIG	(None)	0	0.0	Peak config
83		PK HR VOL	M <sup>3</sup>	1	0.0	Peak hour volume
84		PK HR TIME	(None)	0	0.0	Peak hour time
85		PK DY VOL	M <sup>3</sup>	1	0.0	Peak day volume
86		PK DY TIME	(None)	0	0.0	Peak day time
87 - 89 reserved						
90		%DEV	%RANG	0	0	0=Normal under/over range fault bits; Non-zero; see section 12.2.1.

**SECTION 11**

**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.

<b>CHANNEL NUMBER</b>	<b>CHANNEL LABEL</b>	<b>DECIMAL PLACES</b>	<b>DIGITS</b>	<b>LOGGING TYPE</b>
21	METR TEMP	2	4	Average
20	METR PRES	1	6	Average
22	LIVE SG	3	6	Average
52	LOG UVOL	1	8	Snapshot and Zero
54	LOG CVOL	1	8	Snapshot and Zero
56	TODAY VOL	1	8	Snapshot
57	YSDAY VOL	1	8	Snapshot

**11.2 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
- ATMS PRES
- PRES BASE
- TEMP BASE
- FIXED SG
- CO2
- N2
- METR FCTR
- FPV FCTR
- VPP1

PP1  
ZFLOW LIM  
%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 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).

### 11.4 CHANNEL 19 AUXILIARY INPUT

Channel 19 can be used to furnish an additional analog input from a standard 1-to-5 VDC transmitter. This analog input can be another pressure, temperature, etc. reading from an auxiliary sensor. This input will not show up on the display or the HHDT and the input cannot be scaled or adjusted. However this input will show up on the printed log without any heading and can be defined by the alphanumeric entry (ChTLD) of the LOG DEFINE prompt. All calculations with this reading must be made externally to the SolarFlow Plus. For example, if there was an additional pressure transducer connected that reflected a pressure of 0-500 PSIG, a pressure of 500 PSIG would send a signal of 5.0 VDC. The number 5.0 would show on the printed log with no heading. The LOG DEFINE prompt entry (ChTLD) could be 019A21. This number would be decoded to mean that the number is an unspecified input from channel 19 with a value averaged over the logged interval. The number value has two digits with one number after the decimal point.

**SECTION 12**

**12.0 ALARM DEFINITIONS**

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

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)		0	PRES LOW
4	C(20)>Z*S(20,F)	6900	1.01	PRES HIGH
5	C(21)<Z*S(21,F)	6900	0	TEMP LOW
6	C(21)>Z*S(21,F)	66	1.01	TEMP HIGH
7	C(22)<Z*S(22,F)	66	0	SG LOW
8	C(22)>Z*S(22,F)	0.8	1.01	SG HIGH
9	C(55)<Z	0.8	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

\* Alarms 1 and 2 are not applicable for the AGA-7 single meter run configuration. The user should deactivate alarms 1 and 2 as described later in this section.

## 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:

$$Z = 1.01$$

$$F = 6900$$

$S(20,F) =$  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:

$$\text{The setpoint for Alarm \#4 is} = 1.01 * 6900 = 6969$$

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 FAULT BITS

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.

<u>Date</u>	<u>Time</u>	<u>METR</u>	<u>TEMP</u>	<u>METR</u>	<u>PRES</u>	<u>DIFF</u>	<u>PRESS</u>	<u>TODAY</u>	<u>VOL</u>
<u>U-Range</u>	<u>O-Range</u>	<u>Misc.</u>							
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. This application has the ability to disable under and over range fault bits that show up in the data log. The fault bits are disabled when the corresponding analog input is undefined or in the fixed mode. If the analog input is live during any part of the log period, fault bits will be set if under or over range and logged for that log period. 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 live analog inputs that were in an Under-Range condition any time during the log interval.
- b. O-Range which will list any of the live 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.

<b>AGA-3 2480 SNGL</b>	
<b>DECIMAL POINT</b>	<b>ANALOG INPUT</b>
1	(AUX AIN1)
2	Meter pressure, Channel 20
3	Meter temperature, Channel 21
4	Live SG, Channel 22
5	Battery, Channel 23
6-8	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 - Not used
- 2 - Fpv adjusted pressure out of range
- 3 - Fpv adjusted temperature out of range
- 4 - not used
- 5 - Not used
- 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.

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## **SECTION 13**

### **13.0 MODEL 1882 PREAMPLIFIER**

Model 1882 Preamplifier is a low power preamplifier that works with the Model 2480 to increase the frequency of the allowed pulse inputs. Model 1882 Preamplifier enables the Positive Displacement (PD) inputs to be in a frequency range between zero and 5000 Hz. It is located in an explosion proof conduit that is mounted close to the pick-up coil of the PD meter. It is designed to accept a balanced input from a pick-up coil and provide a zero to a five VDC minimum pulse to the input of the Model 2480 flow computer. There is no maintenance required on this unit. Replace it if necessary.

### **13.1 MODEL 1882 INSTALLATION**

For the Model 2480 to work with the Model 1882 Preamplifier, two capacitors (C21 and C22) must be removed from the CPU board on Model 2480. See Figure 13-1. In later Model 2480 units, the capacitors are located in sockets on the CPU board and may be pulled out with your fingers. The output from the Model 1882 Preamplifier should be connected to the Model 2480 at the standard turbine or PD input terminals (pins 17 and 18) on the termination board. Refer to the wiring diagrams in the Model 2480 System Reference manual as necessary.

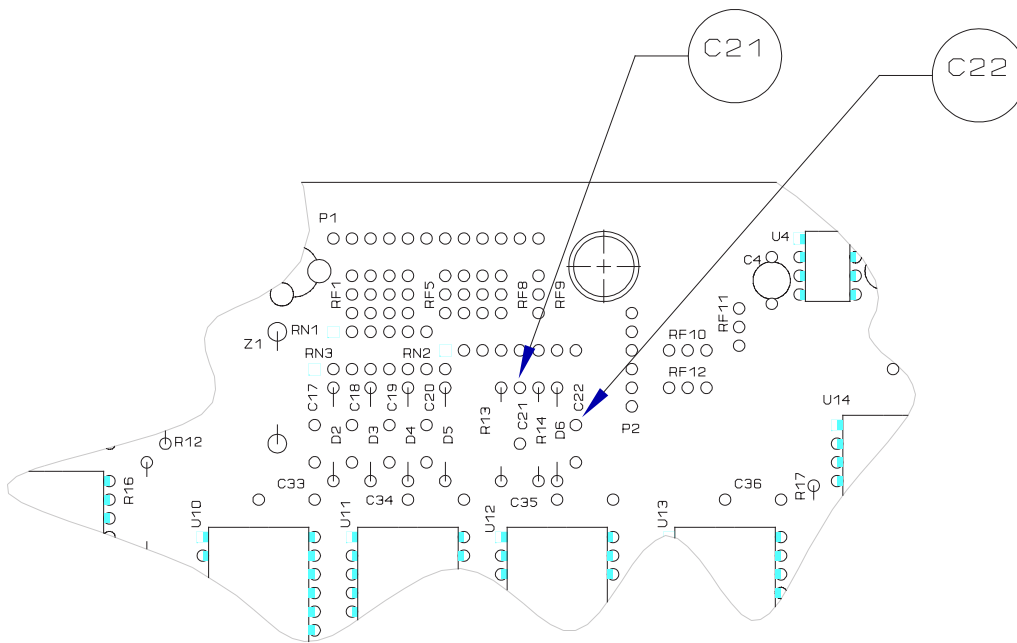


Figure 13-1. Location of Capacitors C21 and C22

**13.2 MODEL 1882 SPECIFICATIONS**

**13.2.1 ELECTRICAL**

Input	pick-up coil
Frequency range	1 - 5 KHz
Minimum signal level	6 millivolts p-p at 10 KHZ
Maximum signal level	8 volts p-p at 5 KHZ
Maximum distance from pick-up coil	Two feet
Output signal level with 6 volts applied	High minimum 5.3 volts at 1.8 mA source Low maximum 0.6 volts at 1.8 mA sink
Maximum distance from preamp to Model 2480	100 feet
Power requirement	5-9 volts at 2 mA maximum

**13.2.2 ENVIRONMENTAL**

Operating Temperature	-20 to +160 degrees F.
Humidity	0 to 95 % non-condensing

**13.2.3 MECHANICAL**

Dimensions	1-5/8" W x 1" H x 3" L
Weight	Approximately 8 ounces
Mounting	two sets of 4 x 40 x 1-1/4" RH screws with lock washers

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## **SECTION 14**

### **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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## **SECTION 15**

### **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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## **SECTION 16**

### **16.0 HIGH SPEED CHANNEL READS**

This application supports high speed channel reads with DSI protocol.

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## SECTION 17

## 17.0 HOURLY AND DAILY PEAK DETECTION

This application also supports hourly and daily peak detection using the following channels:

CH NO.	LABEL	DESCRIPTION
02	PK RESET	YES; if grounded for at least 1/2 second, then Peak Value Channels 83 through 86 are reset if PK CONFIG (Channel 82) = 0.
82	PK CONFIG	0 = Reset of Peak Value Channels via Ch# 2 if enabled. 1 = Reset Peak Value Channels to default values, then reset PK CONFIG (CH# 82) to its previous value before it was set to 1. 2 = Reset Peak Value Channels (Channels 83 through 86) to defaults on the first of the month at contract hour. 3 = Reset Peak Value Channels (Channels 83 through 86) to defaults daily at contract hour. (NOTE: This mode disables Channels 85 and 86)
83	PK HR VOL	The corrected volume accumulated during the hour of peak flow since Channels 83 through 86 were last reset.
84	PK HR TIME	Date/Time stamp (YYMMDDhh) of the PK HR VOL (Ch#83).
85	PK DY VOL	The corrected volume accumulated during the day (ended at contract hour) of peak flow since Channels 83 through 86 were last reset.
86	PK DY TIME	Date/Time stamp (YYMMDDhh) of the PK DY VOL (Ch# 85).

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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 and Control 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.

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**DANIEL**

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