ULTRA 3000 DEFINITION SPECIFICATION

ULTRA 3000

DUAL ORIFICE IIRTD

ORIFICE DEFINITION

AND CONFIGURATION

Part Number 3-9009-015
Revision A

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DANIEL
Instruments, Inc.

DANIEL INDUSTRIES, INC.
ULTRA 3000
DUAL ORIFICE IIRTD
ORIFICE DEFINITION AND CONFIGURATION

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1.0 INTRODUCTION

The Ultra 3000 AGA3 Definitions have been designed for use with orifice meters and implement the required features of natural gas flow computers.

1.1 SCOPE OF SPECIFICATION

The Ultra 3000 involves a three-tiered approach to design. This task-oriented approach involves:

- Definition -- The flow engineer defines a specific application. This includes the number of tubes, assignment of inputs to functions, choosing a flow calculation method, etc.

- Configuration -- The field technician chooses a definition which has been previously defined by a flow engineer. He then is able to calibrate inputs, set pipe sizes, collect, data, etc.

- Tool Generation Programs -- When necessary, a software engineer will be asked to create a new tool or protocol driver.

This specification provides specific information on a Ultra 3000 system which supports one of nine standard orifice definitions. Basic reference information on the Ultra 3000 system can be found in the Field Engineer's Manual and the Field Technician's Manual. A detailed description of the terminology (definitions,tools, ladders) and general procedure for generating a new definition are provided in the Flow Engineer's Manual. The Field Technician's Manual covers definitions and concepts necessary for installing, configuring, and using the Ultra 3000.

This specification includes sections on :

- Flow rate equations per API Chapter 14.3 Part 3
- Gas Chromatograph Interface Capability
- Tube Switching
- Valve Positioning Capability
- Default Security Codes
- Default Audit Logs 1 and 2 Lists
- EFM Display List

- Definition Specific Sub-Menus
- Default Alarm List
- Diagnostics Menu Representing Default Calibration Parameters
- Daniel Modbus ASCII Register List

1.2 AGA3 DEFINITION/CONFIGURATION FEATURES

The primary features of the Ultra 3000 AGA3 Definition software are as follows:

- Provides Modbus Communications for remote access
- Serves as a dual orifice meter definition using AGA3 1992
- Supports AGA-8 1992 (both detail and gross methods)
- Accepts standard transducer assignments, and 500 OHM RTD input for Temperature
- Allows the user access to all auxiliary analog inputs and their scales
- Supports a serial interface with the Daniel Chromatograph, but will default to the use of operator entered gas quality values
- Supports tube switching
- Provides an analog output proportional to flow rate for station flow rate
- Performs valve positioning using analog output to control corrected flow rate
- Provides a pulse output for each meter run based on individual meter run volume

1.3 AGA3 DUAL ORIFICE IIRTD DEFINITION

The AGA3 Dual Orifice IIRTD Definition uses flow rate equations from API Chapter 14.3 which are included in this specification.

1.3.1 DEFINITION HARDWARE REQUIREMENTS

This orifice definition uses the IOU Type 2 Card. The following hardware is required to support the Dual Orifice IIRTD Definition (Part Number 8-3109-015), unless the inputs are using fixed values.

INPUTS	OUTPUTS	NAME	REQUIREMENT	I/O TYPE & QTY.
1		Metr Pres1	1-5 volts	2 1
1		Metr Pres2	1-5 volts	
1		Diff Pres1	1-5 volts	
1		Diff Pres2	1-5 volts	
1		Flw Temp1	500 OHM RTD	
1		Flw Temp2	500 OHM RTD	
	2	Flow Rate/Valve Pos	1-5 volts	
	2	Volume	Contact Closures	
ADDITIONAL UNASSIGNED I/O CONFIGURABLE USING EFMACCS DEFINITION S/W				
4		Aux. Status In	Contact Closures	
4		Aux Analog In	1-5 volts	
	1	Open	Contact Closures	
	1	Close	Contact Closures	

1.3.2 DEFINITION FIELD WIRING MAP

NAME	REQUIREMENT	INPUTS	OUTPUTS	IOU BOARD #
Pres1	1-5 volts	Analog Input #3		1
Pres2	1-5 volts	Analog Input #6		1
Diff Pres1	1-5 volts	Analog Input #1		1
Diff Pres2	1-5 volts	Analog Input #4		1
Flw Temp1	500 OHM RTD			1
Flw Temp2	500 OHM RTD			1
Aux Anlg 7	1-5 volts	Analog Input #7		1
Aux Anlg 8	1-5 volts	Analog Input #8		1
DIn1	Contact Closure	Digital Input #1		1
DIn2	Contact Closure	Digital Input #2		1
DIn3	Contact Closure	Digital Input #3		1
DIn4	Contact Closure	Digital Input #4		1
VP 1	Contact Closure		Digital Output #1	1
VP 2	Contact Closure		Digital Output #2	1
Open 2	Contact Closure		Digital Output #3	1
Close 2	Contact Closure		Digital Output #4	1
Flow Rate1/Valve Pos1	1-5 volts		Analog Output #1	1
Flow Rate2/Valve Pos2	1-5 volts		Analog Output #2	1

1.4 CALCULATIONS

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

- Analog input sampling and average rate calculation
- Corrected flow rate and volume and calculation

These processes are usually run independently without regard for the state of the other. When the volume calculation process begins a new cycle, it signals the sampling process for new inputs required for a flow calculation. Upon receiving this signal, the sampling process transfers the inputs that have accumulated to the calculation process, and begins new accumulations.

1.4.1 FLOW RATE EQUATIONS

The Ultra calculates volumetric flow rate using equations 3-6b and 3-7 from API Chapter 14.3 Part 3. These equations are:

$$Q_b = (14.73/P_b) * (T_b/519.67) * (Z_b/Z_s) * Q_v \qquad \text{Eqn. 3-7}$$

$$Q_v = 7709.61 * C_d * E_v * Y * d^2 * \qquad \text{Eqn. 3-6b}$$

$$\text{sqrt}(P_{f1} * h_w * Z_s / (G_r * Z_{f1} * T_f))$$

where :

Q_b	=	volumetric flow rate in SCFH at base conditions
Q_v	=	volumetric flow rate in SCFH at standard conditions
P_b	=	base pressure in PSIA
T_b	=	base temperature in Rankine
Z_b	=	gas compressibility at base conditions
Z_s	=	gas compressibility at standard conditions
C_d	=	orifice discharge coefficient
E_v	=	velocity of approach factor
Y	=	expansion factor
d	=	temperature corrected orifice diameter
P_{f1}	=	upstream pressure in PSIA
T_f	=	flowing temperature in Rankine
h_w	=	differential pressure in InH2O
G_r	=	real gas relative density at standard conditions
Z_{f1}	=	flowing compressibility at P_{f1} & T_f

Standard conditions = 14.73 PSIA and 519.67 Rankine

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

All input gravity values used in the Ultra are assumed to be for reference conditions of 14.73 PSIA and 60 °F. This assumption is consistent with calculation examples given in API Chapter 14.3, Part 3. If the operator indicates that the input gravity is the ideal relative density, the ideal value is converted to G_r before the flow rate calculation is run. This value is internal to the flow calculation, and does not replace the specific gravity value the operator entered into the Ultra.

The quantity, sqrt(P_{f1} * h_w), is stored as a separate entity, FLOW EXTN, in the Ultra and is stored in the data log by default. This is in accordance with the COGM document on electronic flow meters.

1.4.2 ENERGY RATE EQUATION

The Ultra calculates volumetric energy rate using the following equation:

Erate	=	1.0E-06 * Qb * Energy
1.0E-06	=	conversion factor to convert energy from BTU to Dekatherm
Qb	=	volumetric flow rate in standard cubic feet per hour at base conditions
Energy	=	energy in BTUs at 14.73 PSIA and 60 DEGF
Erate	=	volumetric energy rate in Dekatherms at base conditions

1.4.3 RATE AND VOLUME CALCULATION

The Ultra calculates rates, volumes, and compressibility on a periodic basis, once a minute.

At the beginning of the calculation cycle, the analog input averages accumulated during the preceding I/O ladder are transferred to the CALC LADDER. Using these inputs, a new flow calculation is done. The flowing compressibility is calculated first, followed by the instantaneous flow rate. The rates and volumes are updated last.

1.4.4 LOGGING

The logging function is a part of the calculation ladder. During each cycle, the Ultra updates all of the running averages for the log. For Analog Inputs in the log, "flow averages" are kept based on flowing conditions. The meter is considered to be flowing if the differential pressure for that meter is above the cut-off value. Averaging is not performed during "no flow" conditions; this results in zero values for logging purposes.

1.5 GAS CHROMATOGRAPH INTERFACE

The Ultra 3000 supports retrieval of gas composition and gas quality from the Model 2251 Danalyzer Gas Chromatograph Controller. The Ultra polls the chromatograph if one of its serial ports has been configured for 'GC' protocol. It uses the communications parameters (baud rate, RTS delay, etc...) that are configured for that serial port.

To enable the gas chromatograph interface, three pieces of information must be programmed into the Ultra. These are the MODBUS communication address of the chromatograph, GC selected as one of the serial communications ports; and the chromatograph stream number of the data are required. The first two are configured with the Ultra 'Ports' Menu. The stream number is configured with the online Config Menu.

The Ultra initiates a poll of the GC about once every four minutes. If the poll is not successful, the poll will be retried every 4 seconds until the poll succeeds. Each poll of the GC is made up of a series of MODBUS queries for chromatograph data. If any query fails, the poll sequence is aborted.

The first poll to the GC is for the time of the current analysis. This time stamp is saved for comparison later. Next, the current stream number is read. Next a poll is issued for the BTU content and specific gravity, followed by a poll for the 11 component values supported by the Model 2251. The final poll retrieves the chromatograph alarms and the analysis time stamp again. If the alarms denoted by the chromatograph's MODBUS registers 3046 and 3047 are non-zero, or the analysis time does not match that of the first poll, the sequence is aborted. Otherwise, the data is processed and used in the Ultra.

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

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

If the retrieved value for Nitrogen exceeds 50 percent, the data is discarded and no further processing is done. The most common cause of a value greater than 50 percent for Nitrogen is the reassignment of MODBUS register numbers done when Neo-Pentane is deleted from the Model 2251 configuration. If this component must be deleted, a dummy component should be inserted in its place to preserve the register assignments as shown. This is the only check the Ultra does on the retrieved data before storing.

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

Hexane	0.47466
Heptane	0.3534
Octane	0.17194

These fractions are the default values used by Model 2251 in the calculation of the reported value for BTU content.

1.6 TUBE SWITCHING

Definitions with two or more meter runs in the Ultra 3000 support meter tube switching based on differential pressure (DP). The primary run (meter run #1) is assumed to be always flowing, and the Ultra will control the other run(s) by means of digital outputs connected to shutoff valves. Two differential pressure setpoints are used for the switched run. The differential open setpoint is the DP which must be observed on a meter run before the next run will be opened. The differential close setpoint is the DP level below which a run must fall before it is closed. (i.e. - Run #2 is opened when run #1 exceeds some predefined DP, and closed when DP #2 falls below a different level of predefined DP.)

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

In addition to the simplified algorithm above, the tube-switching feature may be enabled and disabled by an operator selection entry into the tube-switch enable input. If the feature is disabled, the Ultra completely ignores all other tube-switching parameters and performs no tube-switching control at all and opens all runs.

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

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

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

1.7 VALVE POSITIONING

The Ultra 3000 provides flow rate control based on rate or rate with pressure over-ride and also supports differential pressure over-range protection. The Ultra controls the flow rate by means of an analog output (1-5 VDC) connected to a control valve. The valve positioning function can be configured to operate in various ways based on the value of the following configuration variables:

Valve positioning mode (VP Mode)	NONE [0]=none (disabled) FLWRT [1]=flow rate only UpPrOR [2]=rate w/upstream pressure over-ride DnPrOR[3]=rate w/downstream pressure over-ride
Flow setpoint	desired flow rate in MCFH
Deadband	in % of setpoint
Small step	step for fine control
Large step	step for fast control
Fine control error limit	in % of setpoint
Over-ride pressure	in PSIG
Differential pressure over-range limit	in InH2O
Preset valve position	valve position for DP over-ride
Update time in seconds	valve positioning update time

If the function is disabled or the Maintenance Mode (Maint Mode ENABLE[1]) is enabled, no control is done. To fix the valve position to a specific value, place the output in the fixed mode and enter the desired fixed value. This value will be maintained regardless of any configuration variables. If the function is enabled, and the valve position has not been fixed by the operator, the valve positioning function runs each I/O ladder sample time after the analog inputs have been sampled.

1.7.1 DIFFERENTIAL PRESSURE OVER-RANGE PROTECTION

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

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

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

1.7.2 FLOW RATE CONTROL (VP MODE = FLW RT[1])

The Ultra attempts to cause the measured station flow rate to match a user entered flow rate setpoint. Each I/O cycle, a timer is incremented. If this timer is less than the programmed update time, the function is postponed for another cycle. After the update time has elapsed, the current station flow rate is compared to the setpoint. If the difference (error) is greater than a fine control threshold, a large step is applied to the valve position. Otherwise, if the error is greater than a user programmed deadband, a small step is applied to the valve position. If the error does not exceed the deadband, no change is made to the valve position. The following example illustrates this.

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

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

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

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

where:

Q_{sys} = Flow rate in MCFH from last calculation cycle

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

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

Each I/O cycle, the instantaneous value of the pressure is compared to the over-ride pressure value. If the pressure is less than the over-ride value, normal flow rate control continues. If the pressure exceeds the over-ride value, the small step is added to the valve position for mode 2 or subtracted from the valve position for mode 3.

1.8 FLOW RATE OUTPUT

Ultra provides an analog output proportional to a volumetric flow rate for each meter run. These outputs can be used by external equipment which require an analog indication of the measured flow rate. The flow rate outputs are updated once each calculation cycle. The user is free to rescale these outputs. If the valve positioning option is used for a particular meter run, there is not an analog output for volumetric flow rate for that run.

1.9 VOLUME PULSE OUTPUT

Ultra provides two separate pulse outputs based on individual meter run. Each has a volume per pulse entry and a pulse period entry for configuration. For each output, a volume accumulator holds the volume since the last pulse was output. When the accumulator exceeds the volume per pulse, this volume is subtracted from the accumulator, and a pulse is output. The accumulation is done once each calculation cycle.

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2.0 FIXED MENU DEFAULTS

2.1 SECURITY CODES

Defines the list of users and their security codes for the current configuration.

USER ID	LEVEL
Field Engr	255
Super Tech	200
Field Tech	100
Observer	0

2.2 EFM PARAMETERS

Allows the user to define and/or modify the following configuration parameters for the EFM.

EFM PARAMETERS	SECURITY CLEARANCE	
	READ	WRITE
EFM Parameters	0	100
EFM Security Codes	255	255
EFM Communication Ports	0	100
User Data Log	100	255
EFM Display List	0	255
Log Clear Security Level		255
User Data Log Interval	None	
Contract Hour	8	
Configuration Description	Default Configuration	
Display Inactivity Timeout	60	
Display Scroll Mode:	Blank Screen	
Display Scroll Interval		

2.3 PORTS

Configurable serial and parallel ports:

SERIAL

PORT NO.	**COMM ID.**	**USE**
1	**1**	**MODBUS DANIEL**
PARAMETERS	**DEFAULT**	
Baud Rate	9600	
Parity	Even	
Data Bits	7	
Start Bits	1	
Stop Bits	1	
RTS Required	YES	
RTS Up Delay	200	
RTS Down Delay	10	
CTS Required	NO	
CTS True Abort RTS Up	YES	
CTS False Abort RTS Down	NO	
CTS for Carrier Detect	NO	
CTS Timeout	0	

SERIAL

PORT NO.	COMM ID.	USE
2	**1**	**GC**
PARAMETERS	**DEFAULT**	
Baud Rate	9600	
Parity	Even	
Data Bits	7	
Start Bits	1	
Stop Bits	1	
RTS Required	YES	
RTS Up Delay	200	
RTS Down Delay	10	
CTS Required	NO	
CTS True Abort RTS Up	YES	
CTS False Abort RTS Down	NO	
CTS for Carrier Detect	NO	
CTS Timeout	0	

PARALLEL DEFAULTS

PORT NO.	COMM ID.	USE
1	**1**	**LOCAL**

2.4 AUDIT 1 DATA LOG - 24 HOUR

The following items are included on the data log. Audit data logs 1 and 2 are set to 24-hour and 1-hour log intervals, respectively. The default contract hour is 8:00 am. When a graph is selected the scale range must be entered.

LABEL	DECIMAL PLACES	DIGITS	GRAPH NO.
Log1 Dp1	2	6	0
Log1 Pres1	1	6	0
Log1 Temp1	1	4	0
Log1FlwTm1	2	6	0
Log1 Extn1	2	6	0
Log1 Vol1	0	6	0
Log1 Eng1	0	6	0
Tot Vol 1	0	6	0
Tot Enrgy1	0	6	0
Log1 SpGr1	4	6	0
Log1 BTU_1	2	6	0
Log1 N2_1	1	6	0
Log1 CO2_1	1	6	0
Log1 Dp2	2	6	0
Log1 Pres2	1	6	0
Log1 Temp2	1	4	0
Log1FlwTm2	2	6	0
Log1 Extn2	2	6	0
Log1 Vol2	0	6	0
Log1 Eng2	0	6	0
Tot Vol 2	0	6	0
Tot Enrgy2	0	6	0
Log1 SpGr2	4	6	0
Log1 BTU_2	2	6	0
Log1 N2_2	1	6	0
Log1 CO2_2	1	6	0
St Tot Vol	0	6	0
St Tot Eng	0	6	0

2.5 AUDIT 2 DATA LOG - 1 HOUR

LABEL	DECIMAL PLACES	DIGITS	GRAPH NO.
Log2 Dp1	2	6	0
Log2 Pres1	1	6	0
Log2 Temp1	1	4	0
Log2FlwTm1	2	6	0
Log2 Extn1	2	6	0
Log2 Vol1	0	6	0
Log2 Eng1	0	6	0
Tot Vol 1	0	6	0
Tot Enrgy1	0	6	0
Log2 SpGr1	4	6	0
Log2 BTU_1	2	6	0
Log2 N2_1	1	6	0
Log2 CO2_1	1	6	0
Log2 Dp2	2	6	0
Log2 Pres2	1	6	0
Log2 Temp2	1	4	0
Log2FlwTm2	2	6	0
Log2 Extn2	2	6	0
Log2 Vol2	0	6	0
Log2 Eng2	0	6	0
Tot Vol 2	0	6	0
Tot Enrgy2	0	6	0
Log2 SpGr2	4	6	0
Log2 BTU_2	2	6	0
Log2 N2_2	2	6	0
Log2 CO2_2	0	6	0
St Tot Vol	0	6	0
St Tot Eng	0	6	0

2.6 USER DATA LOG - NONE

2.7 EFM DISPLAY LIST

The DISPLAY List provides for viewing the selected setup parameters and data points from the field user data set unit at any given time. The menu is for display purposes only. No changes can be made to the values displayed using this menu.

POINT NAME	UNITS
F/L Prs1	
Metr Pres1	PSIG
F/L Prs2	
Metr Pres2	PSIG
F/L Tmp1	
Flw Temp1	DEGF
F/L Tmp2	
Flw Temp2	DEGF
F/L Dp1	
Diff Pres1	INH2O
F/L Dp2	
Diff Pres2	INH2O
F/L Aux7	
Aux Anlg7	PCT
F/L Aux8	
Aux Anlg8	PCT
Real Grav	
Energy	BTU/SCF

EFM DISPLAY LIST (CONTINUED)

POINT NAME	UNITS
Flow Rate1	MCF/HR
Tot Vol 1	MCF
Today Vol1	MCF
Ysday Vol1	MCF
Erate 1	DTH/HR
Tot Enrgy1	DTHERM
Tdy Enrgy1	DTHERM
Ysy Enrgy1	DTHERM
Flow Rate2	MCF/HR
Tot Vol 2	MCF
Today Vol2	MCF
Ysday Vol2	MCF
Erate 2	DTH/HR
Tot Enrgy2	DTHERM
Tdy Enrgy2	DTHERM
Ysy Enrgy2	DTHERM
Stn Flw Rt	MCF/HR
St Tot Vol	MCF
St Tdy Vol	MCF
St Ysy Vol	MCF
Stn Erate	DTH/HR
St Tot Eng	DTHERM
St Tdy Eng	DTHERM
St Ysy Eng	DTHERM

3.0 DEFINITION SPECIFIC LABELS

Descriptive labels are shown here for reference only. The column labeled DP in the table indicates the number of digits displayed past the decimal point.

LABEL	UNITS	DP	DEFAULT	DESCRIPTION
AnOutSel	(None)	0	0	Analog Out Selector 1=Valve Positioning 0= Flow Rate
Stn Flw Rt	MCF/HR	1	0.0	Analog flow rate
Valve Pos	%	1	50.0	Current valve position
Version		2	#.##	Software version
Sys Error		0	0	System alarm
Atms Pres	PSIA	2	14.73	Atmospheric pressure
Pres Base	PSIA	2	14.73	Pressure base
Temp Base	DEGF	1	60.0	Temperature base
Orif Mtrl	(None)	0	STAIN[1]	Orifice material
Pipe Mtrl	(None)	0	CARBON[0]	Pipe material
Tref Orif	DEGF	1	68.0	Reference temperature of orifice plate
Tref Pipe	DEGF	1	68.0	Reference temperature of pipe
Spec Heat		2	1.30	Specific heat ratio
SG Select		1	REAL[1]	Input specific gravity 0=ideal, 1=real
Zs1 Entry	(None)	6	1.000000	Compressibility of gas used for ideal specific gravity

LABEL	UNITS	DP	DEFAULT	DESCRIPTION
AGA8 Mthd		0	DETAIL[0]	AGA-8 Method 0=Detail 1=GR, CO2, BTU 2=GR, CO2, N2
Zs		6	1.000000	Standard compressibility
Zb		6	1.000000	Base compressibility
Mol Wt		4	16.8000	Calculated by AGA-8
B		6	0.000000	AGA-8 2nd virial coeff.
C		6	0.000000	AGA-8 3rd virial coeff.
D		6	0.000000	AGA-8 reduced density
K3		6	0.000000	AGA-8 mixture size parameter
Real Grav	(None)	4	0.6000	Current Specific Gravity
Energy	BTU/CF	2	1000.00	Current Energy
Methane	MOL%	4	95.0000	Methane MOL%
Nitrogen	MOL%	4	0.0000	Nitrogen MOL%
CO2	MOL%	4	0.0000	Carbon dioxide MOL%
Ethane	MOL%	4	5.0000	Ethane MOL%
Propane	MOL%	4	0.0000	Propane MOL%
H2O	MOL%	4	0.0000	Water MOL%
H2S	MOL%	4	0.0000	Hydrogen Sulphide MOL%
Hydrogen	MOL%	4	0.0000	Hydrogen MOL%
CO	MOL%	4	0.0000	Carbon Monoxide MOL%
Oxygen	MOL%	4	0.0000	Oxygen MOL%

LABEL	UNITS	DP	DEFAULT	DESCRIPTION
I-Butane	MOL%	4	0.0000	I-Butane MOL%
Butane	MOL%	4	0.0000	Butane MOL%
I-Pentane	MOL%	4	0.0000	I-Pentane MOL%
Pentane	MOL%	4	0.0000	Pentane MOL%
Hexane	MOL%	4	0.0000	Hexane MOL%
Heptane	MOL%	4	0.0000	Heptane MOL%
Octane	MOL%	4	0.0000	Octane MOL%
Nonane	MOL%	4	0.0000	Nonane MOL%
Decane	MOL%	4	0.0000	Decane MOL%
Helium	MOL%	4	0.0000	Helium MOL%
Argon	MOL%	4	0.0000	Argon MOL%
Chrom Addr	(None)	0	1	Chromatograph address
Chrom Strm	(None)	0	1	Chromatograph stream
VPP 1	MCF	1	100.0	Volume per pulse 1
PP 1	SEC	0	20	Pulse period 1
VPP 2	MCF	1	100.0	Volume per pulse 2
PP 2	SEC	0	20	Pulse period 2
TS Enable	(None)	0	DISABL[0]	Tube Switching 0=disable 1=enable
Open 2 SP	INH2O	1	80.0	Valve 2 DP open
Close 2 SP	INH2O	1	20.0	Valve 2 DP close
TS Delay	SEC	0	30	Tube switching delay time
TS Vlv Tim	SEC	0	30	Valve travel time

LABEL	UNITS	DP	DEFAULT	DESCRIPTION
VP Mode	(None)	0	NONE[0]	Valve positioning option 0=disabled 1=flow rate control 2=upstream pressure override 3=downstream pressure override
StFlwSetpt	MCF/HR	1	0.0	Station flow rate setpoint
Deadband	PCT	1	2.0	Control deadband %
Small Step	PCT	2	0.05	Fine valve step %
Large Step	PCT	1	0.5	Coarse valve step %
Fine Cntrl	PCT	0	5	Error limit control %
Ovrd Pres	PSIG	1	0.0	Pres override limit
Preset Pos	PCT	1	50.0	Valve position for DP override
Dp Limit	INH2O	2	0.00	DP override limit 0=disabled
Update Tim	SEC	0	10	Valve position update time
Orif Diam1	IN	3	4.000	Meter 1 orifice diameter
Pipe Diam1	IN	3	8.071	Meter 1 pipe diameter
Tap Lctn 1	(None)	0	UPSTRM[1]	Tap location 0=downstream 1=upstream
Zflow Lim1	INH2O	2	0.50	Low flow cutoff in InH2O
Corr Od1	IN	4	0.0000	Temp corrected orifice diameter
Corr Pd1	IN	4	0.0000	Temp corrected pipe diameter 1

LABEL	UNITS	DP	DEFAULT	DESCRIPTION
Corr Beta1	(None)	5	0.00000	Temp corrected beta ratio
Ev 1	(None)	5	1.00000	Velocity of approach factor
Cd 1	(None)	6	0.600000	Coefficient of discharge
Zf 1	(None)	6	1.000000	Flowing compressibility
Y 1	(None)	6	1.000000	Expansion factor
Flw Extn 1	(None)	3	0.000	sqrt(Hw*Pf)
Flw Time 1	MIN	2	0.00	Flow time
Flow Rate1	MCF/HR	1	0.0	Hourly flow rate
Dly FlwRt1	MCF/D	1	0.0	Daily flow rate
Log Vol 1	MCF	0	0	Logged accumulated volume
Today Vol1	MCF	0	0	Daily accumulated volume
Ysday Vol1	MCF	0	0	Ysday's accumulated volume
Tot Vol 1	MCF	0	0	Total accumulated volume (Rolls over @ 10,000,000)
Erate 1	DTH/HR	1	0.0	Energy flow rate
Log Enrgy1	DTHERM	0	0	Logged accumulated energy
Tdy Enrgy1	DTHERM	0	0	Today's accumulated energy
Ysy Enrgy1	DTHERM	0	0	Ysday's accumulated energy
Tot Enrgy1	DTHERM	0	0	Total accumulated energy (Rolls over @ 10,000,000)
Orif Diam2	IN	3	4.000	Meter 2 orifice diameter

LABEL	UNITS	DP	DEFAULT	DESCRIPTION
Pipe Diam2	IN	3	8.071	Meter 2 pipe diameter
Tap Lctn 2	(None)	0	UPSTRM[1]	Tap location 0=downstream 1=upstream
Zflow Lim2	INH2O	2	0.50	Low flow cutoff in InH2O
Corr Od2	IN	4	0.0000	Temp corrected orifice diameter
Corr Pd2	IN	4	0.0000	Temp corrected pipe diameter 2
Corr Beta2	(None)	5	0.00000	Temp corrected beta ratio2
Ev 2	(None)	5	1.00000	Velocity of approach factor
Cd 2	(None)	6	0.600000	Coefficient of discharge
Y 2	(None)	6	1.000000	Expansion factor
Flw Extn 2	(None)	3	0.000	sqrt(Hw*Pf)
Flw Time 2	MIN	2	0.00	Flow time
Flow Rate2	MCF/HR	1	0.0	Hourly flow rate
Dly FlwRt2	MCF/D	1	0.0	Daily flow rate
Log Vol 2	MCF	0	0	Logged accumulated volume
Today Vol2	MCF	0	0	Daily accumulated volume
Ysday Vol2	MCF	0	0	Ysday's accumulated volume
Tot Vol 2	MCF	0	0	Total accumulated volume (Rolls over @ 10,000,000)
Erate 2	DTH/HR	1	0.0	Energy flow rate

LABEL	UNITS	DP	DEFAULT	DESCRIPTION
Log Enrgy2	DTHERM	0	0	Logged accumulated energy
Tdy Enrgy2	DTHERM	0	0	Today's accumulated energy
Ysy Enrgy2	DTHERM	0	0	Ysday's accumulated energy
Tot Enrgy2	DTHERM	0	0	Total accumulated energy (Rolls over @ 10,000,000)
Stn Flw Rt	MCF/HR	1	0.0	Station flow rate per hour
St DFlw Rt	MCF/D	1	0.0	Station flow rate per day
Log StVol	MCF	0	0	Station logged volume
St Tdy Vol	MCF	0	0	Station today's volume
St Ysy Vol	MCF	0	0	Station yesterday's volume
St Tot Vol	MCF	0	0	Station total volume
Stn Erate	DTHERM	1	0.0	Station energy rate
Log Enrgy	DTHERM	0	0	Station logged energy
St Tdy Eng	DTHERM	0	0	Station today's energy
St Ysy Eng	DTHERM	0	0	Station yesterday's energy
St Tot Eng	DTHERM	0	0	Station total energy

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

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4.0 DEFINITION SPECIFIC SUBMENUS

The following submenus are found: Access → Edit → Menus

4.1 ALARMS

The ALARMS SUBMENU allows the user to view alarms and to edit and/or view the alarm limits.

PROMPT	DEFAULT	SECURITY CLEARANCE	
		READ	WRITE
Maint Mode	0	0	100
CutOffAlm1	0	0	N/A
CutOffAlm2	0	0	N/A
Zf Zero 1	0	0	N/A
Zf Zero 2	0	0	N/A
Sys Error1	0	0	N/A
Sys Error2	0	0	N/A
Prs1 LoAlm	0	0	N/A
Prs1 HiAlm	0	0	N/A
Prs2 LoAlm	0	0	N/A
Prs2 HiAlm	0	0	N/A
Tmp1 LoAlm	0	0	N/A
Tmp1 HiAlm	0	0	N/A
Tmp2 LoAlm	0	0	N/A
Tmp2 HiAlm	0	0	N/A

ALARMS (CONTINUED)

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
Dp1 LoAlm	0		0	N/A
Dp1 HiAlm	0		0	N/A
Dp2 LoAlm	0		0	N/A
Dp2 HiAlm	0		0	N/A
Batt LoAlm	0		0	N/A
Rate1LoAlm	0		0	N/A
Rate1HiAlm	0		0	N/A
Rate2LoAlm	0		0	N/A
Rate2HiAlm	0		0	N/A
StnRtLoAlm	0		0	N/A
StnRtHiAlm	0		0	N/A
Prs1 LoLmt	0.0	PSIG	100	100
Prs1 HiLmt	505.0	PSIG	100	100
Prs2 LoLmt	0.0	PSIG	100	100
Prs2 HiLmt	505.0	PSIG	100	100
Tmp1 LoLmt	0.0	DEGF	100	100
Tmp1 HiLmt	151.5	DEGF	100	100
Tmp2 LoLmt	0.0	DEGF	100	100
Tmp2 HiLmt	151.5	DEGF	100	100
Dp1 LoLmt	0.00	INH2O	100	100
Dp1 HiLmt	101.00	INH2O	100	100
Dp2 LoLmt	0.00	INH2O	100	100
Dp2 HiLmt	101.00	INH2O	100	100
Batt LoLmt	5.50	BATT	100	100
Rate1LoLmt	0.0	MCF/HR	100	100
Rate1HiLmt	5000.0	MCF/HR	100	100
Rate2LoLmt	0.0	MCF/HR	100	100
Rate2HiLmt	5000.0	MCF/HR	100	100
StnRtLoLmt	0.0	MCF/HR	100	100
StnRtHiLmt	999999.0	MCF/HR	100	100

4.1.1 LOGGED ALARMS

The Logged Alarms can be viewed via the View Logs sub-menu of the Main Menu of the Electronic Flow Meter Definition and Configuration System. The number of transitions until logging begins have been defaulted to 5 for all logged alarms. Other alarms, such as, CutOffAlm, Zf Zero, etc. do not generate alarm log entries.

LOGGED ALARMS
Prs1 LoAlm
Prs1 HiAlm
Prs2 LoAlm
Prs2 HiAlm
Tmp1 LoAlm
Tmp1 HiAlm
Tmp2 LoAlm
Tmp2 HiAlm
Dp1 LoAlm
Dp1 HiAlm
Dp2 LoAlm
Dp2 HiAlm
Batt LoAlm
Rate1LoAlm
Rate1HiAlm
Rate2LoAlm
Rate2HiAlm
StnRtLoAlm
StnRtHiAlm
Sys Error1
Sys Error2

4.2 ANALOGS

The ANALOGS submenu of this definition provides for toggling between LIVE and FIXED values of the following analogs.

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
Metr Pres1	####.#	PSIG	0	N/A
Metr Pres2	####.#	PSIG	0	N/A
Flw Temp1	###.#	DEGF	0	N/A
Flw Temp2	###.#	DEGF	0	N/A
Diff Pres1	###.##	INH2O	0	N/A
Diff Pres2	###.##	INH2O	0	N/A
Aux Anlg 7	###.##	PCT	0	N/A
Aux Anlg 8	###.##	PCT	0	N/A
Battery	##.##	BATT	0	N/A
Flow Rate1	#####.#	MCF/HR	0	N/A
Valve Pos1	50.0	PCT	0	N/A
Flow Rate2	#####.#	MCF/HR	0	N/A
Valve Pos2	50.0	PCT	0	N/A
Inst Prs1	####.#	PSIG	100	N/A
Inst Prs2	####.#	PSIG	100	N/A
Inst Tmp1	###.#	DEGF	100	N/A
Inst Tmp2	###.#	DEGF	100	N/A
Inst Dp1	###.##	INH2O	100	N/A
Inst Dp2	###.##	INH2O	100	N/A
Inst Aux7	###.##	PCT	100	N/A
Inst Aux8	###.##	PCT	100	N/A
Inst Batt	##.##	BATT	100	N/A
Pct Flow 1	0.00	%OPEN	100	N/A
Pct Flow 2	0.00	%OPEN	100	N/A

ANALOGS (CONTINUED)

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
F/L Prs1	LIVE[0]		100	100
Man Pres1	485.3	PSIG	100	100
F/L Prs2	LIVE[0]		100	100
Man Pres2	485.3	PSIG	100	100
F/L Tmp1	LIVE[0]		100	100
Man Temp1	109.0	DEGF	100	100
F/L Tmp2	LIVE[0]		100	100
Man Temp2	109.0	DEGF	100	100
F/L Dp1	LIVE[0]		100	100
Man Dp1	20.00	INH2O	100	100
F/L Dp2	LIVE[0]		100	100
Man Dp2	20.00	INH2O	100	100
F/L Aux7	LIVE[0]		100	100
Man Aux7	0.00	PCT	100	100
F/L Aux8	LIVE[0]		100	100
Man Aux8	0.00	PCT	100	100
AnOut1 Sel	0		0	100
AnOut2 Sel	0		0	100
F/L AOut1	LIVE[0]		100	100
Man AOut1	0.00	%OPEN	100	100
F/L AOut2	LIVE[0]		100	100
Man AOut2	0.00	%OPEN	100	100
Maint Mode	DISABL[0]		0	100

- represents live values

4.3 SCALES

The high- and low-scale values for the analogs shown in the following table can be modified in the SCALES submenu.

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
M Pres1/Lo	0.0	PSIG	100	100
M Pres1/Hi	500.0	PSIG	100	100
M Pres2/Lo	0.0	PSIG	100	100
M Pres2/Hi	500.0	PSIG	100	100
M Temp1/Lo	0.0	DEGF	100	100
M Temp1/Hi	150.0	DEGF	100	100
M Temp2/Lo	0.0	DEGF	100	100
M Temp2/Hi	150.0	DEGF	100	100
DPres1/Lo	0.00	INH2O	100	100
DPres1/Hi	100.00	INH2O	100	100
DPres2/Lo	0.00	INH2O	100	100
DPres2/Hi	100.00	INH2O	100	100
Aux 7 Lo	0.0	PCT	100	100
Aux 7 Hi	100.0	PCT	100	100
Aux 8 Lo	0.0	PCT	100	100
Aux 8 Hi	100.0	PCT	100	100
Battery Lo	0.00	BATT	100	100
Battery Hi	15.83	BATT	100	100
FlwRt1 Low	0.0	MCF/HR	0	100
FlwRt1 Hi	5000.0	MCF/HR	0	100
FlwRt2 Low	0.0	MCF/HR	0	100
FlwRt2 Hi	5000.0	MCF/HR	0	100

4.4 DIGITALS

The DIGITALS submenu provides for viewing and/or editing the digital inputs and outputs.

PROMPT	DEFAULT	SECURITY CLEARANCE	
		READ	WRITE
VP 1	0	0	N/A
VP 2	0	0	N/A
Open 2	1	0	N/A
Close 2	0	0	N/A
DIn1	0	0	N/A
DIn2	0	0	N/A
DIn3	0	0	N/A
DIn4	0	0	N/A
Dout1	0	0	N/A
Dout2	0	0	N/A
Dout3	1	0	N/A
Dout4	0	0	N/A
F/L Dout1	LIVE[0]	100	100
Man Dout1	OFF[0]	100	100
F/L Dout2	LIVE[0]	100	100
Man Dout2	OFF[0]	100	100
F/L Dout3	LIVE[0]	100	100
Man Dout3	OFF[0]	100	100
F/L Dout4	LIVE[0]	100	100
Man Dout4	OFF[0]	100	100

4.5 CONFIG

The following default parameters can be changed in the CONFIG submenu.

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
Orif Diam1	4.000	IN	0	100
Pipe Diam1	8.071	IN	0	100
Zflow Lim1	0.50	INH2O	0	100
Tap Lctn 1	UPSTRM[1]		0	100
Orif Diam2	4.000	IN	0	100
Pipe Diam2	8.071	IN	0	100
Zflow Lim2	0.50	INH2O	0	100
Tap Lctn 2	UPSTRM[1]		0	100
Atms Pres	14.73	PSIA	0	100
Pres Base	14.73	PSIA	0	100
Temp Base	60.0	DEGF	0	100
AGA8 1Mthd	DETAIL[0]		0	100
AGA8 2Mthd	DETAIL[0]		0	100

CONFIG (CONTINUED)

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
SG Select	REAL[1]		0	100
Real Grav	0.6000		0	100
Zs1 Entry	1.000000		0	100
Orif Mtrl1	STAIN[1]		0	100
Pipe Mtrl1	CARBON[0]		0	100
Tref Orif1	68.0	DEGF	0	100
Tref Pipe1	68.0	DEGF	0	100
Orif Mtrl2	STAIN[1]		0	100
Pipe Mtrl2	CARBON[0]		0	100
Tref Orif2	68.0	DEGF	0	100
Tref Pipe2	68.0	DEGF	0	100
Chrom Strm	1		0	100
Version	#.##		0	N/A

4.6 CONTROL

4.6.1 CONTROL RUN 1

The CONTROL RUN 1 submenu provides for entering the control values for the pulse outputs.

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
VPP 1	100.0	MCF	0	N/A
PP l	20	SEC	0	100
VP 1 Mode	NONE[0]		0	100
Flw1Setpt	0.0	MCF/HR	0	100
Deadband1	2.0	PCT	0	100
SmallStep1	0.05	PCT	0	100
LargeStep1	0.5	PCT	0	100
FineCntrl1	5	PCT	0	100
Ovrd Pres1	0.0	PSIG	0	100
Dp Limit1	0.00	INH2O	0	100
PresetPos1	50.0	PCT	0	100
Update Tm1	10	SEC	0	100
Valve Pos1	50.0	PCT	0	100
F/L VPOut1	FIXED[1]		0	100
FxdVP1 Val	50.0	PCT	0	100
AnOut1 Sel	0		0	100
Inst Rate1	0.0	MCF/HR	0	100
Flow Rate1	0.0	MCF/HR	0	100
Diff Pres1	0.00	INH2O	0	100
Metr Pres1	0.0	PSIG	0	100
Maint Mode	DISABL[0]		0	100
pplowlim1	4	SEC	100	100
max_puls1	100		100	100

4.6.2 CONTROL RUN 2

The CONTROL RUN 2 submenu provides for entering the control values for the pulse outputs.

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
VPP 2	100.0	MCF	0	N/A
PP 2	20	SEC	0	100
TS Enable	DISABL[0]		0	100
Open 2 SP	80.0	INH2O	0	100
Close 2 SP	20.0	INH2O	0	100
TS Delay	30	SEC	0	100
TS Vlv Tim	30	SEC	0	100
VP 2 Mode	NONE[0]		0	100
Flw2Setpt	0.0	MCF/HR	0	100
Deadband2	2.0	PCT	0	100
SmallStep2	0.05	PCT	0	100
LargeStep2	0.5	PCT	0	100
FineCntrl2	5	PCT	0	100
Ovrd Pres2	0.0	PSIG	0	100
Dp Limit2	0.00	INH2O	0	100
PresetPos2	50.0	PCT	0	100
Update Tm2	10	SEC	0	100
Valve Pos2	50.0	PCT	0	100
F/L VPOut2	FIXED[1]		0	100
FxdVP2 Val	50.0	PCT	0	100
AnOut2 Sel	0		0	100
Inst Rate2	0.0	MCF/HR	0	100
Flow Rate2	0.0	MCF/HR	0	100
Diff Pres2	0.00	INH2O	0	100
Metr Pres2	0.0	PSIG	0	100
Maint Mode	DISABL[0]		0	100
pplowlim2	4	SEC	100	100
max_puls2	100		100	100

4.7 CALCULATED DATA

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

PROMPT	SAMPLE VALUES		SECURITY CLEARANCE
			READ
AGA8 1Mthd	DETAIL[0]		0
Zs 1	0.997811		0
Zb 1	0.997811		0
Flow Rate1	426.4	MCF/HR	0
Ev 1	1.03162		100
Cd 1	0.603111		100
Y 1	0.999521		100
Flw Extn 1	100.003		0
Zf 1	0.948100		0
B 1	-0.051740		100
K3 1	0.100912		100
Mol Wt 1	16.7444		100
AGA8 2Mthd	DETAIL[0]		0
Zs 2	0.997811		0
Zb 2	0.997811		0
Flow Rate2	426.4	MCF/HR	0
Ev 2	1.03162		100
Cd 2	0.603111		100
Y 2	0.999521		100
Flw Extn 2	100.003		0
Zf 2	0.948100		0
B 2	-0.051740		100
K3 2	0.100912		100
Mol Wt 2	16.7444		100

4.8 LIVE GAS DATA

Data retrieved from the Gas Chromatograph can be read in this menu.

PROMPT	DEFAULT		SECURITY CLEARANCE
			READ ONLY
Chrom Strm	1		0
Energy	0.00	BTU	0
CO2	0.0000	MOL%	100
Ethane	0.0000	MOL%	100
I-Butane	0.0000	MOL%	100
I-Pentane	0.0000	MOL%	100
Methane	0.0000	MOL%	100
Nitrogen	0.0000	MOL%	100
N-Butane	0.0000	MOL%	100
N-Heptane	0.0000	MOL%	100
N-Hexane	0.0000	MOL%	100
N-Octane	0.0000	MOL%	100
N-Pentane	0.0000	MOL%	100
Propane	0.0000	MOL%	100
Spec Grav	0.0000		100
GC Fail	0		100
F/L GC	FIXED [1]		100
GC timeout	120 SEC		100

4.9 FIXED GAS DATA

Entries for gas specific parameters can be edited in this submenu.

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
Spec Grav	0.6000		0	100
Energy	1000.00	BTU/SCF	0	100
CO2	0.0000	MOL%	100	100
Nitrogen	0.0000	MOL%	100	100
Spec Heat1	1.30		100	100
Spec Heat2	1.30		100	100
Methane	95.0000	MOL%	100	100
Ethane	5.0000	MOL%	100	100
Propane	0.0000	MOL%	100	100
Water	0.0000	MOL%	100	100
H2S	0.0000	MOL%	100	100
Hydrogen	0.0000	MOL%	100	100
CO	0.0000	MOL%	100	100
Oxygen	0.0000	MOL%	100	100
I-Butane	0.0000	MOL%	100	100
N-Butane	0.0000	MOL%	100	100
I-Pentane	0.0000	MOL%	100	100
N-Pentane	0.0000	MOL%	100	100
N-Hexane	0.0000	MOL%	100	100
N-Heptane	0.0000	MOL%	100	100
N-Octane	0.0000	MOL%	100	100
N-Nonane	0.0000	MOL%	100	100
N-Decane	0.0000	MOL%	100	100
Helium	0.0000	MOL%	100	100
Argon	0.0000	MOL%	100	100

4.10 RATES AND VOLUMES

The RATES AND VOLUMES can be monitored on this screen.

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
Flow Rate1	0.0	MCF/HR	0	N/A
Dly FlwRt1	0.0	MCF/D	0	N/A
Today Vol1	0	MCF	0	N/A
Ysday Vol1	0	MCF	0	N/A
Tot Vol 1	0	MCF	0	N/A
Flow Rate2	0.0	MCF/HR	0	N/A
Dly FlwRt2	0.0	MCF/D	0	N/A
Today Vol2	0	MCF	0	N/A
Ysday Vol2	0	MCF	0	N/A
Tot Vol 2	0	MCF	0	N/A
Stn Flw Rt	0.0	MCF/HR	0	N/A
St DFlw Rt	0.0	MCF/D	0	N/A
St Tdy Vol	0	MCF	0	N/A
St Ysy Vol	0	MCF	0	N/A
St Tot Vol	0	MCF	0	N/A

RATES AND VOLUMES (CONTINUED)

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
Erate 1	0.0	DTH/HR	0	N/A
Dly Erate1	0.0	DTH/DAY	0	N/A
Tdy Enrgy1	0	DTHERM	0	N/A
Ysy Enrgy1	0	DTHERM	0	N/A
Tot Enrgy1	0	DTHERM	0	N/A
Erate 2	0.0	DTH/HR	0	N/A
Dly Erate2	0.0	DTH/DAY	0	N/A
Tdy Enrgy2	0	DTHERM	0	N/A
Ysy Enrgy2	0	DTHERM	0	N/A
Tot Enrgy2	0	DTHERM	0	N/A
Stn Erate	0.0	DTH/HR	0	N/A
StDlyErate	0.0	DTH/DAY	0	N/A
St Tdy Eng	0	DTHERM	0	N/A
St Ysy Eng	0	DTHERM	0	N/A
St Tot Eng	0	DTHERM	0	N/A

4.11 DIAGNOSTICS

The DIAGNOSTICS SUBMENU allows the user to edit and /or view the calibration parameters.

PROMPT		DEFAULTS		SECURITY CLEARANCE	
				READ	WRITE
Inst Prs1		####.#	PSIG	100	100
RawLS Prs1		12484	COUNTS	100	100
RawHS Prs1		62420	COUNTS	100	100
Tol Prs1		25		100	100
CalPtsPrs1		0		100	100
AsFndPrs1	ARRAY			100	100
AsLeftPrs1	ARRAY			100	100
RAsLftPrs1	ARRAY			100	100
OfstUsPrs1	NO [0]			100	100
OfAsFdPrs1		0.0	PSIG	100	100
OfAsLfPrs1		0.0	PSIG	100	100
Inst Prs2		####.#	PSIG	100	100
RawLS Prs2		12484	COUNTS	100	100
RawHS Prs2		62420	COUNTS	100	100
Tol Prs2		25		100	100
CalPtsPrs2		0		100	100
AsFndPrs2	ARRAY			100	100
AsLeftPrs2	ARRAY			100	100
RAsLftPrs2	ARRAY			100	100
OfstUsPrs2	NO [0]			100	100
OfAsFdPrs2		0.0	PSIG	100	100
OfAsLfPrs2		0.0	PSIG	100	100

DIAGNOSTICS (CONTINUED)

PROMPT		DEFAULTS		SECURITY CLEARANCE	
				READ	WRITE
Inst Tmp1		###.#	DEGF	100	100
RawLS Tmp1		30484	COUNTS	100	100
RawHS Tmp1		40584	COUNTS	100	100
Tol Tmp1		25		100	100
CalPtsTmp1		0		100	100
AsFndTmp1	ARRAY			100	100
AsLeftTmp1	ARRAY			100	100
RAsLftTmp1	ARRAY			100	100
OfstUsTmp1	NO [0]			100	100
OfAsFdTmp1		0.0	DEGF	100	100
OfAsLfTmp1		0.0	DEGF	100	100
Inst Tmp2		###.#	DEGF	100	100
RawLS Tmp2		30484	COUNTS	100	100
RawHS Tmp2		40584	COUNTS	100	100
Tol Tmp2		25		100	100
CalPtsTmp2		0		100	100
AsFndTmp2	ARRAY			100	100
AsLeftTmp2	ARRAY			100	100
RAsLftTmp2	ARRAY			100	100
OfstUsTmp2	NO [0]			100	100
OfAsFdTmp2		0.0	DEGF	100	100
OfAsLfTmp2		0.0	DEGF	100	100

DIAGNOSTICS (CONTINUED)

PROMPT		DEFAULTS		SECURITY CODES	
				READ	WRITE
Inst Dp1		###.##	INH2O	100	100
RawLS Dp1		12482	COUNTS	100	100
RawHS Dp1		62411	COUNTS	100	100
Tol Dp1		25		100	100
CalPtsDp1		0		100	100
AsFndDp1	ARRAY			100	100
AsLeftDp1	ARRAY			100	100
RAsLftDp1	ARRAY			100	100
OfstUsDp1	NO [0]			100	100
OfAsFdDp1		0.00	INH2O	100	100
OfAsLfDp1		0.00	INH2O	100	100
Inst Dp2		###.##	INH2O	100	100
RawLS Dp2		12484	COUNTS	100	100
RawHS Dp2		62420	COUNTS	100	100
Tol Dp2		25		100	100
CalPtsDp2		0		100	100
AsFndDp2	ARRAY			100	100
AsLeftDp2	ARRAY			100	100
RAsLftDp2	ARRAY			100	100
OfstUsDp2	NO [0]			100	100
OfAsFdDp2		0.00	INH2O	100	100
OfAsLfDp2		0.00	INH2O	100	100

DIAGNOSTICS (CONTINUED)

PROMPT		DEFAULTS		SECURITY CODES	
				READ	WRITE
Inst Aux7		###.##	PCT	100	100
RawLS Aux7		12484	COUNTS	100	100
RawHS Aux7		62420	COUNTS	100	100
Tol Aux7		25		100	100
CalPtsAux7		0		100	100
AsFndAux7	ARRAY			100	100
AsLeftAux7	ARRAY			100	100
RAsLftAux7	ARRAY			100	100
OfstUsAux7		NO [0]		100	100
OfAsFdAux7		0.00	PCT	100	100
OfAsLfAux7		0.00	PCT	100	100
Inst Aux8		###.##	PCT	100	100
RawLS Aux8		12484	COUNTS	100	100
RawHS Aux8		62420	COUNTS	100	100
Tol Aux8		25		100	100
CalPtsAux8		0		100	100
AsFndAux8	ARRAY			100	100
AsLeftAux8	ARRAY			100	100
RAsLftAux8	ARRAY			100	100
OfstUsAux8		NO [0]		100	100
OfAsFdAux8		0.00	PCT	100	100
OfAsLfAux8		0.00	PCT	100	100

DIAGNOSTICS (CONTINUED)

PROMPT		DEFAULTS		SECURITY CODES	
				READ	WRITE
Inst Batt		##.##	BATT	100	100
RawLS Batt		0	COUNTS	100	100
RawHS Batt		255	COUNTS	100	100
To1 Batt		25		100	100
CalPtsBatt		0		100	100
AsFndBatt	ARRAY			100	100
AsLeftBatt	ARRAY			100	100
RAsLftBatt	ARRAY			100	100
OfstUsBatt	NO [0]			100	100
OfAsFdBatt		0.00	BATT	100	100
OfAsLfBatt		0.00	BATT	100	100

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5.0 COMMUNICATIONS

5.1 DANIEL MODBUS ASCII REGISTER LIST

1001	Din1
1002	Din2
1003	Din3
1004	Din4
7006	Cur Month
7007	Cur Day
7008	Cur Year
7009	Cur Hour
7010	Cur Min
7011	Cur Sec
7012	Inst Prs1
7013	Diff Pres1
7014	Flw Temp1
7015	Metr Pres1
7016	Valve Pos1
7017	Log2 Btu_1
7018	Flow Rate1
7019	Flw1Setpt
7020	Today Vol1
7021	Ysday Vol1
7022	Orif Diam1
7023	Spec Grav
7024	CO2
7025	Nitrogen
7026	Inst Prs2
7027	Diff Pres2
7028	Flw Temp2
7029	Metr Pres2
7030	Valve Pos2
7031	Log2 Btu_2
7032	Flow Rate2
7033	Flw2Setpt
7034	Today Vol2
7035	Ysday Vol2
7036	Orif Diam2
7037	Spec Grav
7038	CO2
7039	Nitrogen

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6.0 AGA8 NOMINAL RANGES FOR THE DETAIL AND GROSS CHARACTERIZATION METHODS

QUANTITY	RANGE		
Relative Density	0.56	to	0.87
Gross Heating Value	477	to	1150 Btu/Scf
Methane Mole%	45.2	to	98.3
Nitrogen Mole%	0.3	to	53.6
Carbon Dioxide Mole%	0.04	to	28.94
Ethane Mole%	0.24	to	9.53
Propane Mole%	0.02	to	3.57
Butanes Mole%	0.01	to	1.08
Pentanes Mole%	0.002	to	0.279
Hexanes Plus Mole%	0.0005	to	0.1004
Helium Mole%	0.0	to	0.158
Hydrogen Mole%	0.0		
Carbon Monoxide Mole%	0.0		
Argon Mole%	0.0		
Oxygen Mole%	0.0		
Water Mole%	0.0	to	0.05
Hydrogen Sulfide Mole%	0.0	to	0.02

Gross Method - Temperatures from 32.0 to 130.0 DegF
Pressures from atmospheric to 1200 Psia

Detail Method - Temperatures from -200.0 to 760 DegF
Pressures from atmospheric to 40,000 Psia

Reference - AGA8 Nov 1992 Manual

AGA3 NOMINAL RANGES
Orifice Diameters greater than 0.45 inches
Pipe Diameters 2.0 inches and greater
Pipe Reynolds numbers greater than or equal to 4000
Beta ratios of 0.10 to 0.75
Temperatures -50.0 to 350.0 DegF
Pressures 0.0 to 5000.0 Psig
Differential Pressures 0.0 to 750.0 InH2O

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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 (713) 467-6000, Fax (281) 897-2901, or contact:

   Daniel Instruments, Inc.
   P. O. Box 55435
   Houston, Texas 77255

   When contacting Daniel for product service, the purchaser is asked to provide information as indicated on the following "Customer Problem Report".

   Daniel Instruments, Inc. 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 INSTRUMENTS, INC.
ATTN: CUSTOMER SERVICE
19203 HEMPSTEAD HIGHWAY
HOUSTON, TEXAS 77065

PHONE: (281) 897-2900
FAX: (281) 897-2901

The sales and service offices of Daniel Industries, Inc. are located throughout the United States and in major countries overseas. Please contact Daniel Instruments, Inc. at P. O. Box 55435, Houston, Texas 77255, or phone (713) 467-6000 for the location of the sales or service office nearest you. Daniel Instruments, Inc. offers both on-call and contract maintenance service designed to provide single-source responsibility for all Daniel Instruments, Inc. products.

DANIEL
Instruments, Inc.