ULTRA 3000 DEFINITION SPECIFICATION

ULTRA 3000

TGS SINGLE ORIFICE DEFINITION

STARTUP CONFIGURATION

(1-36SD, 1-RTD)

Part Number 3-9009-001
Revision H

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DANIEL
Instruments, Inc.

DANIEL INDUSTRIES, INC.
ULTRA 3000
TGS SINGLE ORIFICE DEFINITION
STARTUP 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.

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
- 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 single orifice meter definition using AGA3 1992
- Supports AGA-8 1992 (both detail and gross methods)
- Accepts standard transducer assignments, including 36SD smart sensor for Static Pressure and Differential Pressure plus 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
- Performs valve positioning using an analog output to control flow rate (single analog outputs can be switched between valve positioning and flow rate)
- Provides an analog output proportional to flow rate
- Provides two pulse outputs based on volume

1.3 AGA3 TGS SINGLE ORIFICE DEFINITION

The AGA3 TGS Single Orifice 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 1 Card. The following hardware is required to support the TGS Single Orifice Definition (Part Number 8-3109-001), unless the inputs are using fixed values.

INPUTS	OUTPUTS	NAME	REQUIREMENT	I/O TYPE & QTY.
1		Pres1/Diff. Pres1	36SD	1 1
1		Flw Temp1	500 OHM RTD	
	1	Flow Rate/Valve Control	1-5 volts	
	2	Station Volume	Contact Closures	
ADDITIONAL UNASSIGNED I/O CONFIGURABLE USING EFMACCS DEFINITION S/W				
2		Aux. Anlg. In	1-5 volts	
4		Aux. Status In	Contact Closures	
	2	Aux. Control Out	Contact Closures	

1.3.2 DEFINITION FIELD WIRING MAP

NAME	REQUIREMENT	INPUTS	OUTPUTS	IOU BOARD #
Pres1	36SD			1
Diff Pres1	36SD			1
Aux Pres 1	1-5 volts	Analog Input #1		1
Aux Anlg 2	1-5 volts	Analog Input #2		1
Flw Temp1	RTD			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
DOUT3	Contact Closure		Digital Output #3	1
DOUT4	Contact Closure		Digital Output #4	1
Flw Rt Out/ Valve Pos	1-5 volts		Analog Output #1	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 calculation

These processes are usually executed 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

NOTE: The TGS definition has been modified to accept customer specific input units of Kg/CM^2 for pressure, degrees C for temperature, $MJoules/M^3$ for energy, MMH2O for differential pressure, and MM for orifice and pipe diameters. Base conditions are defined as a pressure of 101.325 KPascal (14.696 PSIA) at 15.00°C (59.00°F) in accordance to International Standards Organization and customer specification. All input values are converted to U.S. equivalent units prior to flow calculation. All Outputs of calculations are converted to metric and customer specified units.

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

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

$$Q_v = 7709.61 * C_d * E_v * Y * d^2 * \sqrt{P_{f1} * h_w * Z_s / (G_r * Z_{f1} * T_f)} \qquad \text{Eqn. 3-6b}$$

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 = ((Qb * Energy) / 38.9279) * 1.0E-03

1.0E-03 = conversion factor to convert cubic meters to 1000M3

Qb = volumetric flow rate in cubic meters per hour at base conditions

Energy = energy in MJ/M3

38.9279 = base energy value

Erate = volumetric energy rate in 1000M3/H 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 query 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 queried. Next a query is issued for the BTU content and specific gravity, followed by a query for the 11 component values supported by the Model 2251. The final query 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 query, the sequence is aborted. Otherwise, the data is processed and used in the Ultra.

Other error deletion/data validity checks include:

1. Each response byte count is verified. If more or less total bytes received than expected, data is not used.

2. Stream number must be between 1 and 8 or data is not used.

3. Mol fractions must add to 100% ±5% or analysis is not used.

4. Gravity must be greater than 0.001 and less than 2.000 or analysis will not be used.

5. Total energy content must be within the limits of 0.0 and 100,000 or analysis will not be used.

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 performed. 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 performs 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 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 1000M3/H
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 KgCM2G
Differential pressure over-range limit	in MMH_2O
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 executes each I/O ladder sample time after the analog inputs have been sampled.

1.6.1 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.

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

The Ultra attempts to cause the measured 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 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	14.1584 1000M3/H
Small step	0.1 %
Deadband	1 %
Large step	0.3 %
Fine control	
Error limit	5 %

If the observed flow rate is below 13.4505 1000M3/H, 0.3 percent will be added to the valve position (above 14.8663, 0.3 percent will be subtracted). Otherwise, if the rate is below 14.0168 1000M3/H, 0.1 percent will be added to the valve position (above 14.3, 0.1 percent will be subtracted). If the observed flow rate is between 14.0168 and 14.3 1000M3/H, 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 1000M3/H from last calculation cycle

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

1.6.3 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.

1.6.4 FLOW RATE OUTPUT

Ultra provides an analog output proportional to a station volumetric flow rate. This output is provided for use 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 this output. If the valve positioning option is used, there is not an analog output for volumetric flow rate for single boards.

1.6.5 VOLUME PULSE OUTPUT

Ultra provides two separate pulse outputs based on station volume. 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.

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	100	255
EFM Security Codes	255	255
EFM Communication Ports	0	100
User Data Log	100	255
EFM Display List	0	200
Log Clear Security Level		0
User Data Log Interval	None	
Contract Hour	6	
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	1200	
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 6:00 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	4	6	0
Log1 Temp1	3	6	0
Log1FlwTm1	2	6	0
Log1 Extn1	3	7	0
Log1 Vol1	3	7	0
Log1 Eng1	3	7	0
Log1 AuxP	4	6	0
Log1 Enrgy	4	6	0
Log1 RGrav	4	6	0
Log1 CO2	4	6	0
Log1 N2	4	6	0
Log1 Meth	4	6	0
Log1 Ethan	4	6	0
Log1 Propn	4	6	0
Log1 IButn	4	6	0
Log1 NButn	4	6	0
Log1 IPent	4	6	0
Log1 NPent	4	6	0
Log1 NHexn	4	6	0
Log1 NHept	4	6	0
Log1 NOctn	4	6	0

2.5 AUDIT 2 DATA LOG - 1 HOUR

LABEL	DECIMAL PLACES	DIGITS	GRAPH NO.
Log2 Dp1	2	6	0
Log2 Pres1	4	6	0
Log2 Temp1	3	6	0
Log2FlwTm1	2	6	0
Log2 Extn1	3	7	0
Log2 Vol1	3	7	0
Log2 Eng1	3	7	0
Log2 AuxP	4	6	0
Log2 Enrgy	4	6	0
Log2 RGrav	4	6	0
Log2 CO2	4	6	0
Log2 N2	4	6	0
Log2 Meth	4	6	0
Log2 Ethan	4	6	0
Log2 Propn	4	6	0
Log2 IButn	4	6	0
Log2 NButn	4	6	0
Log2 IPent	4	6	0
Log2 NPent	4	6	0
Log2 NHexn	4	6	0
Log2 NHept	4	6	0
Log2 NOctn	4	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	KG/CM2G
F/L Dp1	
Diff Pres1	MMH2O
F/L Tmp1	
Flw Temp1	DEGC
F/L AuxP	
Aux Pres 1	KG/CM2G
F/L Aux2	
Aux Anlg 2	PCT
Flow Rate1	1000M3/H
Today Vol1	1000M3
Ysday Vol1	1000M3
Erate1	1000M3/H
Tdy Enrgy1	1000M3
Ysy Enrgy1	1000M3
GC Fail	
Enrgy Used	MJ/M3
Real Grav	
CO2	MOL%
Nitrogen	MOL%
Methane	MOL%
Ethane	MOL%
Propane	MOL%
I-Butane	MOL%
N-Butane	MOL%
I-Pentane	MOL%
N-Pentane	MOL%
N-Hexane	MOL%
N-Heptane	MOL%
N-Octane	MOL%

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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 Rate1
Flow Rate1	1000M3/H	3	0.000	Analog flow rate
Valve Pos	%	1	50.0	Current valve position
Version		2	#.##	Software version
Sys Error		0	0	System alarm
Atms Pres	KG/CM2A	4	1.0332	Atmospheric pressure
Pres Base	KPAA	3	101.325	Pressure base
Temp Base	DEG C	2	15.00	Temperature base
Orif Mtrl	(None)	0	STAIN[1]	Orifice material
Pipe Mtrl	(None)	0	CARBON[0]	Pipe material
Tref Orif	DEGC	3	20.000	Reference temperature of orifice plate
Tref Pipe	DEGC	3	20.000	Reference temperature of pipe
Spec Heat		2	1.30	Specific heat ratio
SG Select		0	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	MJ/M3	4	38.9279	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%
I-Butane	MOL%	4	0.0000	I-Butane MOL%
Butane	MOL%	4	0.0000	Butane MOL%

LABEL	UNITS	DP	DEFAULT	DESCRIPTION
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	1000M3	1	100.0	Volume per pulse 1
PP 1	SEC	0	10	Pulse period 1
VPP 2	1000M3	1	100.0	Volume per pulse 2
PP 2	SEC	0	10	Pulse period 2
VP Mode	(None)	0	NONE[0]	Valve positioning option 0=disabled 1=flow rate control 2=upstream pressure override 3=downstream pressure override
Flw Setpnt	1000M3/H	3	0.000	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	KG/CM2G	4	0.0000	Pres override limit

LABEL	UNITS	DP	DEFAULT	DESCRIPTION
Preset Pos	PCT	0	50	Valve position for DP override
Dp Limit	MMH2O	2	0.00	DP override limit 0=disabled
Update Tim	SEC	0	10.0	Valve position update time
Orif Diam1	MM	4	101.6000	Meter 1 orifice diameter
Pipe Diam1	MM	4	205.0034	Meter 1 pipe diameter
Tap Lctn 1	(None)	0	UPSTRM[1]	Tap location 0=downstream 1=upstream
Zflow Lim1	MMH2O	2	12.70	Low flow cutoff in MMH2O
Corr Od1	IN	4	0.0000	Temp corrected orifice diameter
Corr Pd1	IN	4	0.0000	Temp corrected pipe diameter 1
Corr Beta	(None)	5	0.00000	Temp corrected beta ratio
Ev 1	(None)	6	1.000000	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 Extn1	(None)	3	0.000	sqrt(Hw*Pf)
Flw Time 1	MIN	2	0.00	Flow time
Flow Rate1	1000M3/H	3	0.000	Hourly flow rate
Dly VRate	1000M3/D	3	0.000	Daily flow rate
Curr Vol1	1000M3	3	0.000	Logged accumulated volume
Today Vol1	1000M3	3	0.000	Daily accumulated volume

LABEL	UNITS	DP	DEFAULT	DESCRIPTION
Ysday Vol1	1000M3	3	0.000	Ysday's accumulated volume
Tot Vol 1	1000M3	3	0.000	Total accumulated volume (Rolls over @ 100,000,000)
Hrly Erate1	1000M3/H	3	0.000	Energy flow rate
Log Enrgy1	1000M3	3	0.000	Logged accumulated energy
Tdy Enrgy1	1000M3	3	0.000	Today's accumulated energy
Ysy Enrgy1	1000M3	3	0.000	Ysday's accumulated energy
Tot Enrgy1	1000M3	3	0.000	Total accumulated energy (Rolls over @ 100,000,000)

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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
CutOffAlm	0		0	N/A
Zf Zero	0		0	N/A
Sys Error	0		0	N/A
Prs1 LoAlm	0		0	N/A
Prs1 HiAlm	0		0	N/A
Dp1 LoAlm	0		0	N/A
Dp1 HiAlm	0		0	N/A
Tmp1 LoAlm	0		0	N/A
Tmp1 HiAlm	0		0	N/A
AuxP LoAlm	0		0	N/A
AuxP HiAlm	0		0	N/A
Aux2 LoAlm	0		0	N/A
Aux2 HiAlm	0		0	N/A
Batt LoAlm	0		0	N/A
Rate1LoAlm	0		0	N/A
Rate1HiAlm	0		0	N/A
Prs1 LoLmt	0.0000	KG/CM2G	100	100
Prs1 HiLmt	71.0100	KG/CM2G	100	100
Dp1 LoLmt	-25.00	MMH2O	100	100
Dp1 HiLmt	3848.10	MMH2O	100	100
Tmp1 LoLmt	-17.7778	DEGC	100	100
Tmp1 HiLmt	66.3889	DEGC	100	100
AuxP LoLmt	-1.0000	KG/CM2G	100	100
AuxP HiLmt	101.0000	KG/CM2G	100	100
Aux2 LoLmt	-1.00	PCT	100	100
Aux2 HiLmt	101.00	PCT	100	100
Batt LoLmt	5.50	BATT	100	100
Rate1LoLmt	0.000	1000M3/H	100	100
Rate1HiLmt	141.584	1000M3/H	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
Tmp1 LoAlm
Tmp1 HiAlm
Dp1 LoAlm
Dp1 HiAlm
AuxP LoAlm
AuxP HiAlm
Aux2 LoAlm
Aux2 HiAlm
Batt LoAlm
Rate1LoAlm
Rate1HiAlm
Sys Error

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	##.####	KG/CM2G	0	100
Diff Pres1	####.##	MMH2O	0	100
Flw Temp1	###.###	DEGC	0	100
Aux Pres 1	##.####	KG/CM2G	0	100
Aux Anlg 2	###.##	PCT	0	100
Battery	##.##	BATT	0	100
Flow Rate1	0.000	1000M3/H	0	100
Valve Pos	50.0	PCT	0	100
Inst Prs1	##.####	KG/CM2G	100	100
Inst Dp1	####.##	MMH2O	100	100
Inst Tmp1	###.###	DEGC	100	100
Inst AuxP	##.####	KG/CM2G	100	100
Inst Aux2	###.##	PCT	100	100
Inst Batt	##.##	BATT	100	100
Pct Flow 1	0.00	%OPEN	100	100
F/L Prs1	LIVE[0]		100	100
Man Pres1	34.1203	KG/CM2G	100	100
F/L Dp1	LIVE[0]		100	100
Man Dp1	508.00	MMH2O	100	100
F/L Tmp1	LIVE[0]		100	100
Man Temp1	42.780	DEGC	100	100
F/L AuxP	LIVE[0]		100	100
Man AuxP	0.0000	KG/CM2G	100	100
F/L Aux2	LIVE[0]		100	100
Man Aux2	0.00	PCT	100	100

- represents live values

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
F/L AOut1	LIVE[0]		0	100
Man AOut1	0.00	%OPEN	0	100
Maint Mode	DISABL[0]		100	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	0.0000	KG/CM2G	100	100
M Pres1/Hi	71.3070	KG/CM2G	100	100
M Temp1/Lo	-17.7778	DEGC	100	100
M Temp1/Hi	65.5556	DEGC	100	100
D Pres1/Lo	0.00	MMH2O	100	100
D Pres1/Hi	3810.00	MMH2O	100	100
AuxPrs Lo	0.0000	KG/CM2G	100	100
AuxPrs Hi	100.0000	KG/CM2G	100	100
Aux 2 Lo	0.00	PCT	100	100
Aux 2 Hi	100.00	PCT	100	100
Battery Lo	0.00	BATT	100	100
Battery Hi	15.83	BATT	100	100
Flw Rt Low	0.000	1000M3/H	0	100
Flw Rt Hi	141.584	1000M3/H	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
DIn1	0	0	N/A
DIn2	0	0	N/A
DIn3	0	0	N/A
DIn4	0	0	N/A
Dout1	0	0	100
Dout2	0	0	100
Dout3	0	0	100
Dout4	0	0	100
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	101.6000	MM	0	100
Pipe Diam1	205.0034	MM	0	100
Zflow Lim	12.70	MMH2O	0	100
Tap Lctn 1	UPSTRM[1]		0	100
Atms Pres	1.0332	KG/CM2A	0	100
Pres Base	101.325	KPAA	0	100
Temp Base	15.00	DEGC	0	100
AGA8 Mthd	DETAIL[0]		0	100
SG Select	REAL[1]		0	100
Real Grav	0.6000		0	100
Zs1 Entry	1.000000		0	100
Orif Mtrl	STAIN[1]		0	100
Pipe Mtrl	CARBON[0]		0	100
Tref Orif	20.000	DEGC	0	100
Tref Pipe	20.000	DEGC	0	100
Chrom Strm	1		0	100
Hexn Coeff	0.47466		0	100
Hept Coeff	0.35340		0	100
Octn Coeff	0.17194		0	100
Version	#.##		0	N/A

4.6 CONTROL

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

PROMPT	DEFAULT		SECURITY CLEARANCE	
			READ	WRITE
VPP 1	100.0	1000M3	0	100
PP l	10	SEC	0	100
VPP 2	100.0	1000M3	0	100
PP 2	10	SEC	0	100
VP Mode	NONE[0]		0	100
Flw Setpnt	0.000	1000M3/H	0	100
Deadband	2.0	PCT	0	100
Small Step	0.05	PCT	0	100
Large Step	0.5	PCT	0	100
Fine Cntrl	5	PCT	0	100
Ovrd Pres	0.0000	KG/CM2G	0	100
DP Limit	0.00	MMH2O	0	100
Preset Pos	50	PCT	0	100
Update Tim	10	SEC	0	100
Valve Pos	50.0	PCT	0	100
F/L VP Out	FIXED[1]		0	100
FixdVP Val	50	PCT	0	100
AnOutSel	0		0	100
Inst Rate	0.000	1000M3/H	0	100
Flow Rate1	0.000	1000M3/H	0	100
Diff Pres1	0.00	MMH2O	0	100
Metr Pres1	0.0000	KG/CM2G	0	100
Maint Mode	DISABL[0]		0	100
pplowlim1	4	SEC	100	100
max_puls1	100		100	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 Mthd	DETAIL[0]		0
Zs	0.997811		0
Zb	0.997801		0
Flow Rate1	12.078	1000M3/H	0
Ev 1	1.031619		100
Cd 1	0.603111		100
Y 1	0.999521		100
Flw Extn 1	133.634		0
Zf 1	0.948105		0
B	-0.051988		100
K3	0.100912		100
Mol Wt	16.744350		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
GC Fail	0		100
Energy	0.0000	MJ/M3	0
Spec Grav	0.0000		100
CO2	0.0000	MOL%	100
Nitrogen	0.0000	MOL%	100
Methane	0.0000	MOL%	100
Ethane	0.0000	MOL%	100
Propane	0.0000	MOL%	100
I-Butane	0.0000	MOL%	100
N-Butane	0.0000	MOL%	100
I-Pentane	0.0000	MOL%	100
N-Pentane	0.0000	MOL%	100
N-Hexane	0.0000	MOL%	100
N-Heptane	0.0000	MOL%	100
N-Octane	0.0000	MOL%	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
Energy	38.9279	MJ/M3	0	100
Spec Grav	0.6000		0	100
CO2	0.0000	MOL%	100	100
Nitrogen	0.0000	MOL%	100	100
Methane	95.0000	MOL%	100	100
Ethane	5.0000	MOL%	100	100
Propane	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
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
Helium	0.0000	MOL%	100	100
Argon	0.0000	MOL%	100	100
Spec Heat	1.30		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	0.000	1000M3/H	0	N/A
Dly FlwRt1	0.000	1000M3/D	0	N/A
Today Vol1	0.000	1000M3	0	N/A
Ysday Vol1	0.000	1000M3	0	N/A
Tot Vol 1	0.000	1000M3	0	N/A
Erate1	0.000	1000M3/H	0	N/A
Tdy Enrgy1	0.000	1000M3	0	N/A
Ysy Enrgy1	0.000	1000M3	0	N/A
Tot Enrgy1	0.000	1000M3	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		##.####	KG/CM2G	100	100
RawLS Prs1		10000	COUNTS	100	100
RawHS Prs1		50000	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	KG/CM2G	100	100
OfAsLfPrs1		0	KG/CM2G	100	100
Inst Tmp1		###.###	DEGC	100	100
RawLS Tmp1		39173	COUNTS	100	100
RawHS Tmp1		44436	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	DEGC	100	100
OfAsLfTmp1		0	DEGC	100	100
Inst Dp1		####.##	MMH2O	100	100
RawLS Dp1		10000	COUNTS	100	100
RawHS Dp1		30000	COUNTS	100	100
Tol Dp1		25		100	100
CalPtsDp1		0		100	100

DIAGNOSTICS (CONTINUED)

PROMPT		DEFAULTS		SECURITY CODES	
				READ	WRITE
AsFndDp1	ARRAY			100	100
AsLeftDp1	ARRAY			100	100
RAsLftDp1	ARRAY			100	100
OfstUsDp1		NO [0]		100	100
OfAsFdDp1		0	MMH2O	100	100
OfAsLfDp1		0	MMH2O	100	100
Inst AuxP		##.####	KG/CM2G	100	100
RawLS AuxP		36056	COUNTS	100	100
RawHS AuxP		49214	COUNTS	100	100
Tol AuxP		25		100	100
CalPtsAuxP		0		100	100
AsFndAuxP	ARRAY			100	100
AsLeftAuxP	ARRAY			100	100
RAsLftAuxP	ARRAY			100	100
OfstUsAuxP		NO [0]		100	100
OfAsFdAuxP		0	KG/CM2G	100	100
OfAsLfAuxP		0	KG/CM2G	100	100
Inst Aux2		###.##	PCT	100	100
RawLS Aux2		36056	COUNTS	100	100
RawHS Aux2		49214	COUNTS	100	100
Tol Aux2		25		100	100
CalPtsAux2		0		100	100
AsFndAux2	ARRAY			100	100
AsLeftAux2	ARRAY			100	100
RAsLftAux2	ARRAY			100	100
OfstUsAux2		NO [0]		100	100
OfAsFdAux2		0	PCT	100	100
OfAsLfAux2		0	PCT	100	100
Inst Batt		##.##	BATT	100	100
RawLS Batt		0	COUNTS	100	100
RawHS Batt		255	COUNTS	100	100
To1 Batt		25		100	100

DIAGNOSTICS (CONTINUED)

PROMPT		DEFAULTS		SECURITY CODES	
				READ	WRITE
CalPtsBatt		0		100	100
AsFndBatt	ARRAY			100	100
AsLeftBatt	ARRAY			100	100
RAsLftBatt	ARRAY			100	100
OfstUsBatt		NO [0]		100	100
OfAsFdBatt		0	BATT	100	100
OfAsLfBatt		0	BATT	100	100

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5.0 COMMUNICATIONS

5.1 DANIEL MODBUS ASCII REGISTER LIST

32	LogE Accs
701	Log1 Accs Daily Average Gas Quality
702	Log2 Accs Hourly Average Gas Quality
703	Log1 Accs Daily Flow Data Log Meter1
704	Log1 Accs Hourly Flow Data Log Meter1
1001	DIn1
1002	DIn2
1003	DIn3
1004	DIn4
1025	GC Fail
1026	Maint Mode
1035	F/L Dp1
1036	F/L Prs1
1037	F/L Tmpl
1038	F/L AuxP
1039	F/L Aux2
1057	F/L AOut1
1058	F/L VPOut
1070	Dout1
1071	Dout2
1072	Dout3
1073	Dout4
1095	F/L Dout1
1096	F/L Dout2
1097	F/L Dout3
1098	F/L Dout4
1120	Man Dout1
1121	Man Dout2
1122	Man Dout3
1123	Man Dout4
1160	GC Fail
1161	Maint Mode

7001	Hardwre ID
7003	VersionNum
7005	Version
7014	Energy
7015	Real Grav
7040	St Dly ERate
7041	St DFlw Rt
7042	St Tdy Vol
7043	St Tdy Eng
7044	St Ysy Vol
7045	St Ysy Eng
7046	CurDateDMY
7047	Cur Time
7052	Inst Dp1
7053	Inst Prs1
7054	Inst Tmp1
7055	Inst AuxP
7056	Inst Aux2
7082	Pct Flow 1
7083	Valve Pos
7100	Diff Pres1
7101	Metr Pres1
7102	Temp 1
7103	Flw Extn 1
7104	Dly FlwRt1
7105	Dly ERate1
7106	Tdy Vol1
7107	Tdy Eng1
7108	Ydy Vol1
7109	Ydy Eng1
7160	Log1 Recno
7161	Log2 Recno
7162	NumEvents
7163	Pr2DateDMY
7164	Log2 PTime

7166	Prev Hr Avg Dif Press 1
7167	Prev Hr Avg Pressure 1
7168	Prev Hr Avg Temp 1
7169	Prev Hr Flw Extn 1
7170	Prev Hr Volume 1
7171	Prev Hr Energy 1
7211	Log1 Recno
7212	Log2 Recno
7213	NumEvents
7215	Pr1Date DMY
7216	Log1 PTime
7218	Prev Day Avg Diff Press 1
7219	Prev Day Avg Pressure 1
7220	Prev Day Avg Temp 1
7221	Prev Day Flw Extn 1
7222	Ydy Vol1
7223	Ydy Eng1
7260	Prev Day Energy
7261	Prev Day Real Gravity
7262	Prev Day Carbon Dioxide
7263	Prev Day Nitrogen
7264	Prev Day Methane
7265	Prev Day Ethane
7266	Prev Day Propane
7267	Prev Day Iso-Butane
7268	Prev Day N-Butane
7269	Prev Day Iso-Pentane
7270	Prev Day N-Pentane
7271	Prev Day N-Hexane
7272	Prev Day N-Heptane

7273	Prev Day N-Octane
7274	Prev Day N-Nonane
7275	Prev Day Hydrogen Sulfide
7276	Prev Day Hydrogen
7277	Prev Day Helium
7278	Prev Day Oxygen
7279	Prev Day Carbon Monoxide
7285	Prev Hr Energy
7286	Prev Hr Real Gravity
7287	Prev Hr Carbon Dioxide
7288	Prev Hr Nitrogen
7289	Prev Hr Methane
7290	Prev Hr Ethane
7291	Prev Hr Propane
7292	Prev Hr Iso-Butane
7293	Prev Hr N-Butane
7294	Prev Hr Iso-Pentane
7295	Prev Hr N-Pentane
7296	Prev Hr Hexane
7297	Prev Hr Heptane
7298	Prev Hr Octane
7299	Prev Hr Nonane
7300	Prev Hr Hydrogen Sulfide
7301	Prev Hr Hydrogen
7302	Prev Hr Helium
7303	Prev Hr Oxygen
7304	Prev Hr Carbon Monoxide
7310	Fixed Energy
7311	Fixed Real Grav
7312	Fixed CO2
7313	Fixed Nitrogen
7314	Fixed Methane
7315	Fixed Ethane
7316	Fixed Propane
7317	Fixed I-Butane
7318	Fixed N-Butane
7319	Fixed I-Pentane
7320	Fixed N-Pentane

7321	Fixed N-Hexane
7322	Fixed N-Heptane
7323	Fixed N-Octane
7324	Fixed N-Nonane
7325	Fixed N-Decane
7326	Fixed H2S
7327	Fixed Helium
7328	Fixed Water
7329	Fixed Oxygen
7330	Fixed Argon
7331	Fixed Hydrogen
7332	Fixed CO
7333	Pres Base
7334	Temp Base
7335	Atms Pres
7336	Contr Hour
7337	Zflow lim 1
7338	Spec Heat 1
7339	Num Tubes
7340	Chrom Strm
7341	AGA8 1 Mthd
7342	Maint Mode
7345	Tref Pip 1
7346	Tref Ori 1
7420	Pipe Dia 1
7421	Orif Dia 1
7425	Taptype 1
7426	Tap Lctn 1
7490	Inst Dp1
7491	Man Dp1
7492	D Pres 1/Zero
7493	D Pres 1/Full
7515	Inst Prs 1
7516	Man Prs 1
7517	M Pres 1/Zero
7518	M Pres 1/Full
7540	Inst Tmp 1

7541	Man Tmp 1
7542	M Temp 1/Zero
7543	M Temp 1/Full
7570	Pct Flow 1
7571	Man Aout 1
7572	Flw Rt Low
7573	Flw Rt Hi
7575	Valve Pos
7576	Fixed VP Val
7577	Val Pos Lo
7578	Val Pos Hi
7595	Batt LoAlm
7598	Pipe Diam1
7599	Orif Diam1
7604	Energy Rate 1
7605	Prev Hr Energy
7606	Prev Day Energy
7607	Curr Day Energy
7608	Octane
7609	Heptane
7610	Hexane
7611	N-Pentane
7612	Iso-Pentane
7613	N-Butane
7614	Iso-Butane
7615	Propane
7616	Ethane
7617	Methane
7618	Nitrogen
7619	CO2
7620	Specific Gravity
7621	Energy
7622	Prev Hr Energy
7623	Prev Day Energy
7624	Stn Erate
7625	Stn PrevH Eng
7626	Stn PrevD Eng
7627	Stn Tdy Eng
7628	Date
7629	Time

7630	Stn Hrly Vol Rate
7631	Stn Prev Hr Vol
7632	Stn Prev Dly Vol
7633	Stn Tdy Vol
7634	Vol Flow Rate 1
7635	Prev Hr Vol
7636	Prev Day Vol
7637	Curr Day Vol
7638	Diff Pres 1
7639	Static Pres 1
7640	Flow Temp 1
7641	Aux Analog Inp 1.1
7642	Aux Analog Inp 1.2
7643	Analog Out 1
8001	Tot Polls
8002	Good Resp
8003	Bad Resp
8004	Tot Resp
8005	Bad Chars
8006	Overruns
8007	Fram Err
8008	Parity Err
8010	Port Stat

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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	17.772644	to	42.848094 MJ/M3
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 0.0 to 54.44444 DegC
Pressures from 1.0 atmospheric to 81.654872 KG/CM2A

Detail Method - Temperatures from -128.88889 to 404.44444 DegC
Pressures from 1.0 atmospheric to 2721.8291 KG/CM2A

Reference - AGA8 Nov 1992 Manual

AGA3 NOMINAL RANGES
Orifice Diameters greater than 11.429994 mm Pipe Diameters 50.79997 mm and greater Beta ratios of 0.10 to 0.75 Temperatures -45.55556 to 176.66667 Pressures 0.0 to 340.2285 KG/CM2G Differential Pressures 0.0 to 19050.0 mmH2O

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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 (713) 897-2901, or contact:

   Daniel Flow Products, Inc.
   Electronics
   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 Flow Products, Inc., Electronics offers both on call and contract maintenance service designed to afford single source responsibility for all its products.

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 FLOW PRODUCTS, INC.
ATTN: CUSTOMER SERVICE
19203 HEMPSTEAD HIGHWAY
HOUSTON, TEXAS 77065

PHONE: (713) 897-2900
FAX: (713) 897-2901

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

DANIEL

Instruments, Inc.