Enron

Modbus

Protocol

Version 1

For

CB180 FCUs

I. Purpose

This paper describes Modbus Gas Orifice meter communications for Totalflow FCUs as specified by Enron.

II. Background

Totalflow has been asked to implement Modbus ASCII communications for transferring data between TOTALFLOW FCUs and Enron's host computer system. Modbus commands and function codes are described in section 4.11 of the document entitled "Electronic Flow Measurement RTU Technical Specification," published by Enron Corporation.

III. Modbus Description

The Modbus protocol is described in the document entitled "Gould Modbus Protocol Reference Guide" published January, 1985 by Gould Inc., Programmable Control Division, Andover, Massachusetts. Modbus uses the master, slave communications concept. Slave devices speak only when spoken to by the master. Each slave is identified by an unsigned, one byte number ranging from 1 to 247 (inclusive). A slave must send a single response to a master's request for data. The master may broadcast a message to all slaves by sending a zero in the slave address field of the broadcast message. Slaves do not send responses to the master's broadcast. Modbus messages may be one of two formats: ASCII or RTU. The ASCII format is essentially an RTU packet with the following differences:

- Has been converted to hexadecimal ASCII.
- Contains an 8 bit LRC instead of a 16 bit CRC.
- Is wrapped in a simple message frame consisting of begin frame character (:), end frame character (carriage return) and ready (linefeed).

IV. Totalflow Modbus Implementation for Enron

Totalflow Modbus supports only ASCII mode. RTU mode is not described in this document. Broadcast commands are not supported. Totalflow Modbus supports a subset of the Gould Modbus defined function codes. Support has also been added for long integer, floating point, and archive record registers.

Modbus ASCII message frame format:

BOF	Packet	EOF	Ready
:	2 x Number of bytes in Modbus packet	CR	LF

BOF: A colon (:) character is used to indicate beginning of frame.

Packet: The packet field consists of hexadecimal ASCII characters representing the Modbus packet being sent or received. The number of characters is twice the number of bytes in the Modbus packet because each packet byte is converted into two hexadecimal ASCII characters ('0'-'9','A'-'F'.)

EOF/Ready: A carriage return and line feed are used to delineate end of frame.

Modbus packet formats:

Read Query

Address	Function	Register	Quantity	LRC
8-bits	8-bits	16-bits	16-bits	8-bits

Read Response

Address	Function	Byte Count	Data	LRC
8-bits	8-bits	8-bits	N x 8 bits	8-bits

Set Query

Address	Function	Register	Data	LRC
8-bits	8-bits	16-bits	N x 8 bits	8-bits

Set Response

Address	Function	Register	Data	LRC
8-bits	8-bits	16-bits	N x 8 bits	8-bits

Address: The address field contains the slave address of the FCU intended to receive the packet. Each FCU must be assigned a unique address in the range of 1 to 247.

Function: The function code field contains a code which tells the FCU what to do or what data to send. The high order bit in this field may be set by the FCU in the response packet to indicate an error response. Function codes supported:

Function Code	Function	Description
01	Read Boolean	Reads group of boolean registers
03	Read Registers	Reads group of 16/32 bit registers
05	Set Single Boolean	Set or clear a boolean register
06	Set Single Register	Set a 16/32 bit register to specified value
07	Read Exception Status	Reads 8 bit status register
16	Set Multiple Register	Set multiple 16/32 bit registers
128-143	Exception Response	Used by FCU to indicate errors in processing function codes 1-16. FCU responds with function code + 127 for function codes 1-16.

Register: The register field contains the register number of the FCU data item to fetch or set. For read functions, this is the starting register number. Registers are grouped by data type as described in section V below.

Quantity: The quantity field contains the number of consecutive registers to fetch or set, This field is not present in all packets. Only read query packets contain this field.

Byte Count: The byte count field contains the number of bytes of data being transferred. This field is not present in all packets. Only read response packets contain this field.

Data: The data field contains the actual data values being transferred. This field is not present in all packets. The size and format of the data values depend on the register group being accessed. The byte order of integer, long integer, and floating point data values is high to low (MSB....LSB). For archive registers, the entire record is reversed (MSB of last field first, LSB of first field last.) Boolean data is returned bit packed (8 registers / byte) for read functions. The set boolean function contains a 16 bit data field (x0000 to clear a register, xFF00 to set a register.)

LRC: The error check field consists an 8 bit longitudinal redundancy check calculated over the length of the packet field before it is converted to hexadecimal ASCII.

V. Totalflow Modbus Data

This section describes the Modbus register group numbers for Totalflow Enron FCU data. Register numbers are used to identify specific data items to be read or written. Registers are grouped by data type. Table 5.1 depicts Totalflow Enron Modbus register group numbers. For the purposes of this document GO stands for GAS Orifice meter and PI for pulse meter.

Table 5.1 Register Groups

Registers	Type	Description
32	Record	Event or Alarm Records
700	Record	Hourly or Daily Records
1000	BOOLEAN	Digital or Discrete, 1 bit
3000	INTEGER	16 Bit integers
5000	LONG	32 Bit integers
7000	FLOAT	32 Bit IEEE floating point

Table 5.2 Boolean Registers

Boolean registers are read using function code 01 or set using function code 05.

Register	Access	Description
1001	Read/Write	Use Sqrt /linear AP/DP avgs (1 = Sqrt) Defaulted to 0 for PI
1002	Read/Write	Use Y (GO only)
1003	Read/Write	Use F(pv)
1004	Read/Write	Use F(w)
1005	Read/Write	Use F(aux) (GO meter)
1006	Read/Write	Tap location (1 = Upstream) (GO only)
1007	Read/Write	Use calcd / fixed Cd (1 = calcd) (GO only)
1008	Read/Write	Tap Type Support (1 = supported) (GO only)
1009	Read/Write	Tap type (1 = pipe, 0 = flange) (GO only)
1010	Read/Write	RTD installed
1011	Read/Write	Use measured temperature in calcs
1012	Write Only	Reset volume
1013	Write Only	Reset Log Period
1014	Read/Write	Trip contact on Low Charger alarm
1015	Read/Write	Trip contact on DP low alarm (GO only)
1016	Read/Write	Trip contact on DP high alarm (GO only)
1017	Read/Write	Trip contact on AP low alarm
1018	Read/Write	Trip contact on AP high alarm
1019	Read/Write	Trip contact on Remote Sense
1020	Read/Write	Trip contact on volume setpoint
1021	Read/Write	Aux Contact Auto Reset (1 = yes)
1022	Read/Write	Auxiliary Contact State (0/1)
1023	Read/Write	Hold Current Analog Inputs
1024	Read Only	Attached to stream (AIU support)
1025	Read Only	First analysis received (AIU support)
1026	Read/Write	Use Fixed Analysis on error (AIU support)
1027	Read/Write	Use Fixed Water Vapor Content
1028	Write Only	Wakeup FCU from low voltage induced sleep
1029	Read/Write	Use Fixed Test Mode AP, DP(for GO, Pulse for PI), and RTD values.
1030	Read/Write	Use Live AP in Calculations (PI only)
1031	Read/Write	Use Fpb in calculations (PI only)
1032	Read/Write	Use Ftb in calculations (PI only)
1033	Read/Write	Use Faux (PI only)
1034	Read/Write	Use Fpv (PI only)
1035	Read/Write	Trip contact on ACF low alarm (PI only)
1036	Read/Write	Trip contact on ACFhigh alarm (PI only)

Table 5.3 Short Integer Registers
Short integer registers are read using function code 03 or set using function code 06 or 16.

Register	Access	Description
3001	Read Only	Primary element
3002	Read Only	Primary element mask
3003	Read/Write	FCU volume calc. method (1 = 1985, 2 = 1992)
3004	Read Only	FCU volume calc.method mask
3005	Read Only	FCU calculation units
3006	Read Only	FCU calculation units mask
3007	Read/Write	Supercomp method
3008	Read Only	Supercomp method mask
3009	Read/Write	Contract Hour
3010	Read/Write	Volume calculation period
3011	Read/Write	Modbus Slave Address
3012	Read/Write	Remote Comm Baud Rate
3013	Read/Write	Remote Comm Data Bits (7 or 8)
3014	Read/Write	Remote Comm Parity
3015	Read/Write	Remote Comm Stop Bits (1 or 2)
3016	Read/Write	Radio power up delay(milliseconds)
3017	Read/Write	Xmitter key delay(milliseconds)
3018	Read/Write	Xmitter unkey delay (milliseconds)
3019	Read/Write	Remote Comm Protocol (0 = Totalflow, 1 = Modbus)
3020	Read/Write	Remote Comm Link Establish Time (Totalflow Protocol)
3021	Read Only	Maximum Number of Events
3022	Read Only	Sequence Number of Last Event Logged
3023	Read Only	Sequence Number of Last Event Read
3024	Read/Write	Sequence Number of Last Event Acknowledged
3025	Read/Write	Number of unacknowledged events
3026	Read Only	Maximum Number of Log Period Records
3027	Read Only	Sequence Number of current Log Period Record
3028	Read Only	Maximum Number of Day Period Records
3029	Read Only	Sequence Number of current Day Period Record
3030	Read Only	Sequence number of first Log Period Record in current day
3031	Read Only	Vol Period Counter
3032	Read/Write	FCU ID
3033	Read/Write	FCU ID (cont.)
3034	Read/Write	FCU ID (cont.)
3035	Read/Write	FCU ID (cont.)
3036	Read/Write	FCU ID (cont.)
3037	Read/Write	FCU Location
3038	Read/Write	FCU Location (cont.)
3039	Read/Write	FCU Location (cont.)
3040	Read/Write	FCU Location (cont.)
3041	Read/Write	FCU Location (cont.)
3042	Read/Write	FCU Location (cont.)
3043	Read/Write	FCU Location (cont.)
3044	Read/Write	FCU Location (cont.)
3045	Read/Write	FCU Location (cont.)
3046	Read/Write	FCU Location (cont.)
3047	Read/Write	FCU Location (cont.)
3048	Read/Write	FCU Location (cont.)
3049	Read Only	Software Part Number
3050	Read Only	Software Part Number (cont.)
3051	Read Only	Software Part Number (cont.)
3052	Read Only	Software Part Number (cont.)
3053	Read Only	Software Part Number (cont.)
3054	Read Only	Software Part Number (cont.)

Register	Access	Description
3055	Read Only	Software Part Name
3056	Read Only	Software Part Name (cont.)
3057	Read Only	Software Part Name (cont.)
3058	Read Only	Software Part Name (cont.)
3059	Read Only	Software Part Name (cont.)
3060	Read Only	Software Part Name (cont.)
3061	Read Only	Software Part Name (cont.)
3062	Read Only	Software Part Name (cont.)
3063	Read Only	Software Part Name (cont.)
3064	Read Only	Software Part Name (cont.)
3065	Read Only	Software Part Name (cont.)
3066	Read Only	Software Part Name (cont.)
3067	Read Only	Software Revision
3068	Read Only	Software Revision (cont.)
3069	Read Only	Flow window width in seconds (PI Meter)
3070-3089	Read/Write	User integers 0 - 19
3090-3108	Read/Write	User integers 0 - 18

Table 5.4 Long Integer Registers

Access to long integer data is an extension of the Gould Modbus ASCII protocol.
Long integer registers are read using function code 03 or set using function code 06 or 16.

Register	Access	Description
5001		Date / Time
5002		Volume Log period
5003	Read	Log Period Counter
5004		Log Period Start Date/Time
5005		Day Period Start Date/Time
5006		AIU Date/Time
5007		AIU Stream ID
5008		Modbus Security Seed
5009	Read	Extended Feature Flags
5010	Read	Cold Start Date
5011	Read	Total RAM size
5012	Read	Total Banked RAM size
5013	Read	Total Free Banked RAM
5014	Read	Volume calc period in seconds
5015	Read	Total flow time in seconds for last volume calculation period
5016	Read	Last volume calculation period error flags
5017	Read	PI channel 0 one second pulse count
5018	Read	PI channel 1 one second pulse count
5019	Read	PI channel 0 volume calc period pulse count
5020	Read	PI channel 1 volume calc period pulse count

Table 5.5 Floating Point Registers

Access to floating point data is an extension of the Gould Modbus ASCII protocol.
Floating point registers are read using function code 03 or set using function code 06 or 16.

Register	Access	Description
7001	Read Only	Manufacturer ID Number (Always 6000)
7002	Read Only	Operating System Number (PROM Part#)
7003	Read Only	Operating System Revision (PROM Rev)
7004	Read/Write	System Date
7005	Read/Write	System Time
7006	Read/Write	Contract Hour
7007	Read Only	Day Period Record Position
7008	Read Only	Log Period Record Position
7009	Read Only	Number of Events since last Ack
7010	Read/Write	Station ID (0 if non-numeric ID entered)
7011	Read Only	Current battery voltage
7012	Read Only	Current charger voltage
7013	Read Only	Current AP
7014	Read Only	Current DP
7015	Read Only	Current Temp
7016	Read Only	Current flow rate (MCF/Day)
7017	Read Only	Current energy rate (MMBTU/Day)
7018	Read Only	Accumulated Energy since start of contract day (MMBTU)
7019	Read Only	Accumulated Volume since start of contract day (MCF)
7020	Read Only	Previous Hour Average DP (GO only)
7021	Read Only	Previous Hour Average AP
7022	Read Only	Previous Hour Average TF
7023	Read Only	Previous Hour Uncorrected volume (MACF)
7024	Read Only	Previous Hour volume (MCF)
7025	Read Only	Previous Hour energy (MMBTU)
7026	Read Only	Previous Hour Flow Time (MMMM.SS)
7027	Read Only	Previous Hour Time (MMMM.SS)
7028	Read Only	Previous Day Average DP (GO only)
7029	Read Only	Previous Day Average AP
7030	Read Only	Previous Day Average TF
7031	Read Only	Previous Day Uncorrected volume (MACF)
7032	Read Only	Previous Day volume (MCF)
7033	Read Only	Previous Day energy (MMBTU)
7034	Read Only	Previous Day Flow Time (MMMM.SS)
7035	Read Only	Previous Day Time (MMMM.SS)
7036	Read/Write	Fixed Analysis BTU
7037	Read/Write	Fixed Analysis Gravity
7038	Read/Write	Fixed Analysis CO2
7039	Read/Write	Fixed Analysis N2
7040	Read/Write	Fixed Analysis Methane
7041	Read/Write	Fixed Analysis Ethane
7042	Read/Write	Fixed Analysis Propane
7043	Read/Write	Fixed Analysis IButane
7044	Read/Write	Fixed Analysis NButane
7045	Read/Write	Fixed Analysis IPentane
7046	Read/Write	Fixed Analysis NPentane
7047	Read/Write	Fixed Analysis NHexane
7048	Read/Write	Fixed Analysis NHeptane
7049	Read/Write	Fixed Analysis NOctane
7050	Read/Write	Fixed Analysis NNonane
7051	Read/Write	Fixed Analysis H2S

Register	Access	Description
7052	Read/Write	Fixed Analysis Hydrogen
7053	Read/Write	Fixed Analysis Helium
7054	Read/Write	Fixed Analysis Oxygen
7055	Read/Write	Fixed Analysis Carbon Monoxide
7056	Read/Write	Fixed Analysis Argon
7057	Read/Write	Fixed Analysis NDecane
7058	Read/Write	Fixed Analysis H2O
7059	Read/Write	Fixed temperature
7060	Read/Write	Temperature bias
7061	Read/Write	Temperature base
7062	Read/Write	Pressure base
7063	Read/Write	Ratio of specific heats
7064	Read/Write	Viscosity
7065	Read/Write	Fixed Cd
7066	Read/Write	Fixed F(aux)
7067	Read/Write	Fixed F(t) for NX19
7068	Read/Write	Fixed F(p) for NX19
7069	Read/Write	Zba - Z of air at base
7070	Read/Write	Orifice diameter
7071	Read/Write	Orifice plate coef. of expansion
7072	Read/Write	Pipe diameter
7073	Read/Write	Pipe coef. of expansion
7074	Read/Write	Fixed barometric pressure
7075	Read/Write	Fixed Water Vapor Content (LBS/MMSCF)
7076	Read/Write	Water Content Bias (LBS/MMSCF)
7077	Read Only	Last Calc Period diff. pressure
7078	Read Only	Last Calc Period abs. pressure
7079	Read Only	Last Calc Period flowing temp
7080	Read Only	Last Calc Period volume (SCF)
7081	Read Only	Last Calc Period Extension
7082	Read Only	Last Calc Period C'
7083	Read Only	Last Calc Period Y
7084	Read Only	Last Calc Period F(pv)
7085	Read Only	Last Calc Period F(w)
7086	Read Only	Last Calc Period F(aux)
7087	Read Only	Last Calc Period Qv
7088	Read Only	Last Calc Period Fip
7089	Read Only	Last Calc Period Ev
7090	Read Only	Last Calc Period Orif Diameter
7091	Read Only	Last Calc Period Pipe Diameter
7092	Read Only	Last Calc Period Rhob
7093	Read Only	Last Calc Period qm
7094	Read Only	Last Calc Period Cd
7095	Read Only	Last Calc Analysis BTU
7096	Read Only	Last Calc Analysis Gravity
7097	Read Only	Last Calc Analysis CO2
7098	Read Only	Last Calc Analysis N2
7099	Read Only	Last Calc Analysis Methane
7100	Read Only	Last Calc Analysis Ethane
7101	Read Only	Last Calc Analysis Propane
7102	Read Only	Last Calc Analysis IButane
7103	Read Only	Last Calc Analysis NButane
7104	Read Only	Last Calc Analysis IPentane
7105	Read Only	Last Calc Analysis NPentane
7106	Read Only	Last Calc Analysis NHexane
7107	Read Only	Last Calc Analysis NHeptane

Register	Access	Description
7108	Read Only	Last Calc Analysis NOctane
7109	Read Only	Last Calc Analysis NNonane
7110	Read Only	Last Calc Analysis H2S
7111	Read Only	Last Calc Analysis Hydrogen
7112	Read Only	Last Calc Analysis Helium
7113	Read Only	Last Calc Analysis Oxygen
7114	Read Only	Last Calc Analysis Carbon Monoxide
7115	Read Only	Last Calc Analysis Argon
7116	Read Only	Last Calc Analysis NDecane
7117	Read Only	Last Calc Analysis H2O
7118	Read/Write	DP Zero cutoff (GO only)
7119	Read/Write	DP low limit (GO only)
7120	Read/Write	DP hi limit (GO only)
7121	Read/Write	AP lo limit
7122	Read/Write	AP hi limit
7123	Read/Write	Tf low limit
7124	Read/Write	Tf high limit
7125	Read/Write	Flow Rate low limit
7126	Read/Write	Flow Rate high limit
7127	Read/Write	Volume Set Point for contact
7128	Read Only	Accumulated Volume Rollover Setpoint
7129	Write Only	Places User Site Code in Event Log
7130	Read Only	AP low calibration
7131	Read Only	AP mid calibration
7132	Read Only	AP high calibration
7133	Read Only	DP lo calibration
7134	Read Only	DP mid calibration
7135	Read Only	DP high calibration
7136	Read Only	Current Unfiltered Temp
7137	Read Only	Current Unfiltered AP
7138	Read Only	Current Unfiltered DP (GO only)
7140	Read/Write	Test Mode Fixed RTD
7141	Read/Write	Test Mode Fixed AP
7142	Read/Write	Test Mode Fixed DP (Test Pulse Counts PI Meter)
7143	Read	Volume calculation period pulse count (PI)
7144	Read	Current instantaneous flow rate in ACF/Hour (PI)
7145	Read	Uncorrected volume accumulator in ACF (PI)
7146	Read	Previuos day period uncorrected volume in MACF (PI)
7147	Read	Last calculation period uncorrected volume in ACF (PI)
7148	Read	Last calculation period Fpv (PI)
7149	Read	Last calculation period Fpb (PI)
7150	Read	Last calcualtion period Ftb (PI)
7151	Read/Write	Fixed Ap (PI)
7152	Read/Write	ACF low limit (PI)
7153	Read/Write	ACF high limit (PI)
7154	Read	Pulse input 1 meter factor
7155 -7204	Read/Write	User float 0 – User float 49
7205 -7222	Read/Write	User float 0 – User float 17

Table 5.6 AGA 3 Archive Flow Records

Access to daily and hourly archive records is an extension of the Gould Modbus ASCII protocol.
Enron daily and hourly period flow records are read using Modbus function code 03.

Register numbers 701 and 702 are used to indicate Enron daily and hourly flow data. The record number is
passed in the quantity field of the read request. One daily or hourly record may be read per request.

Field	Size	Type	Description
Date	4	FLOAT	Log Date: MMDDYY.0
Time	4	FLOAT	Log Time: HHMM.SS
Dp_avg	4	FLOAT	Average Dp during flow (inches H2O)
AP_avg	4	FLOAT	Average Ap during flow (psig)
TF_avg	4	FLOAT	Average temperature (degrees F)
Extension	4	FLOAT	Uncorrected volume MACF
Volume	4	FLOAT	Volume for the day (MCF)
Energy	4	FLOAT	Energy for the day (MMBTU)
Flow Time	4	FLOAT	Number of minutes of flow in period (MMMM.SS)
	36		Daily Flow Record Length

Table 5.7 AGA7 Archive Flow Records

Access to daily and hourly archive records is an extension of the Gould Modbus ASCII protocol.
Enron daily and hourly period flow records are read using Modbus function code 03.

Register numbers 701 and 702 are used to indicate Enron daily and hourly flow data. The record number is
passed in the quantity field of the read request. One daily or hourly record may be read per request.

Field	Size	Type	Description
Date	4	FLOAT	Log Date: MMDDYY.0
Time	4	FLOAT	Log Time: HHMM.SS
AP_avg	4	FLOAT	Average Ap during flow (psig)
TF_avg	4	FLOAT	Average temperature (degrees F)
Extension	4	FLOAT	Uncorrected volume MACF
Volume	4	FLOAT	Volume for the day (MCF)
Energy	4	FLOAT	Energy for the day (MMBTU)
Flow Time	4	FLOAT	Number of minutes of flow in period (MMMM.SS)
	32		Daily Flow Record Length

Table 5.8 Event Log Record

Access to Event Log archive records is an extension of the Gould Modbus ASCII protocol.
Enron Event records are read using Modbus function code 03.

Register number 32 is used to indicate Enron Event data.

Field	Size	Type	Description
Event Type	2	INTEGER	16 BIT mask for describes event type
Register #	2	INTEGER	16 BIT Register # of affected value
DATE	4	FLOAT	Date of this log record: MMDDYY.0
TIME	4	FLOAT	Time ot this log record: HHMMSS.0
OLD VALUE	4	FLOAT	Value changed from...
NEW VALUE	4	FLOAT	Value changed to...
	20		Event Record Size

Enron Event collection acknowledge is performed using function code 05 and register number 32. After Events have been collected, the host sends an acknowledge to the FCU which then resets the Events collected pointer so that the host collects new Events only.

Table 5.9 Totalflow Event Code / Register Cross Reference

Event Code	Register	Description
1	7004	New date and time
5	7006	Contract day starting hour
8	5007	AIU Stream ID
9	1026	Use fixed anlysis on error?
10	1012	Reset volume
11	1028	Wakeup from sleep
14	7128	Accumulated volume rollover
16	1024	Attached to AIU stream?
20	1010	RTD installed
21	1011	Use fixed temperature
34	1014	Use contact on charger low
35	1015	Contact on dp lo
36	1016	Contact on dp hi
37	1017	Contact on ap lo
38	1018	Contact on ap hi
39	1019	Contact on remote sense
40	1021	Auto re-open
41	1020	Contact on vol set point
50	7129	well log code (Site Code)
51	1012	Accumulated volume reset
61	7070	Orifice diameter
62	7072	Pipe diameter
63	7037	Specific gravity
64	7119	DP lo limit
65	7120	DP hi limit
66	7121	AP lo limit
67	7122	AP hi limit
68	7038	CO2 mole percent
69	7039	N2 mole percent
70	7130	AP lo calibration
71	7131	AP mid calibration
72	7132	AP hi calibration

Register	Access	Description
73	7133	DP lo calibration
74	7134	DP mid calibration
75	7135	DP hi calibration
76	7118	DP zero cutoff
77	7061	Temperature base
78	7062	Pressure base
79	7059	Fixed temperature
80	7060	Temperature bias
81	7064	Viscosity
82	7063	Ratio of specific heats
83	7067	Ft - gravity adjusted temp
84	7068	Fp - gravity adjusted press
85	7036	BTU/SCF
86	7013	AP pressure marker
87	7014	DP pressure marker
100	7066	Faux
102	1025	Initial analys. OK?
108	3007	Z method
111	3005	AGA calculation type
112	7065	Fixed cd
115	7069	Zba
116	7003	Software revision change
117	3010	Volume calculation period
118	5002	Log Period
119	7051	H2S content
120	7058	H20 content
121	7053	Helium content
122	7040	Methane content
123	7041	Ethane content
124	7042	Propane content
125	7044	N-Butane content
126	7043	I-Butane content
127	7046	N-Bentane content
128	7045	I-Pentane content
129	7047	N-Hexane content
130	7048	N-Heptane content
131	7049	N-Octane content
132	7050	N-Nonane content
133	7057	N-Decane content
134	7054	Oxygen content
135	7055	Carbon Monoxide content
136	7071	Orif coef of expansion
137	7073	Pipe coef of expansion
138	7074	barometric pressure
143	1007	Calculated or Fixed Cd in vol calc
144	7056	Fixed Argon mole percent
145	7052	Fixed hydrogen mole percent
146	7128	Accumulated volume rollover
157	1005	Use Faux
158	1006	static pressure tap up/downstream
159	1002	Use Y expansion factor
160	1003	Use Fpv factor
161	1004	Use Fw water vapor factor
162	1013	Reset Log Period
164	1001	Use Linear/Sqrt Averaging
165	1023	Hold last read analog values (AP, DP, TF)
166	3021	Maximum number of events log records
167	3028	Maximum number of day period records

Register	Access	Description
168	3026	Maximum number of log period records
171	5013	Partition memory free space
172	1027	Use fixed water content in wet gas calcs
173	7075	Water content (LBS/MMSCF)
174	7076	Water content bias
175	1029	Use Fixed Test Mode AP, DP, and RTD values

Table 5.10 FCU System Status Byte
Modbus function code 07 returns an 8 bit system status byte.

Bit #	Description
Bit 7	Cold Start
Bit 6	Warm Start
Bit 5	Running
Bit 4	Spare
Bit 3	Unacknowledged Alarms
Bit 2	Spare
Bit 1	Spare
Bit 0	Spare