REV	ACTION	DRAWN	CHECKED	APPROVED	DATE
AF	D10328	LANGBEIN	LANGBEIN	HOLLAND	00/10/03
AG	D20079	JOHNSON	JOHNSON	BUSHNELL	06/11/20
AC	D9113	JUESCHKE	SHORT	HOLLAND	99/11/29
AD	D9818	JUESCHKE	LANGBEIN	HOLLAND	00/06/21
AE	D10262	JOHNSON	JOHNSON	HOLLAND	00/09/19

Totalflow

PG&E

Protocol

for

FCU CB181 w/

ModScan Interface

PRODUCT LINE **TOTALFLOW®**	LEVEL 3	ABB TOTALFLOW PRODUCTS						
DESIGN **JUESCHKE**	**DATE** **00/09/26**	**APPLICATION INFORMATION FOR**						
DRAWN **JUESCHKE**	**00/09/26**	**TOTALFLOW PG&E PROTOCOL FOR CB181 W/MODSCAN MODBUS**						
CHECKED **SHORT**	**99/04/13**							
APPROVED		**SCALE**	**SIZE**	**TYPE**	**DRAWING NO.**	**REV**	**SHEET**	
HOLLAND	**99/04/13**	**NONE**	**A**	**AI**	**2018559**	**AG**	**1** OF **121**	

Table of Contents

I. Purpose

This paper describes the PG&E communications protocol for Totalflow FCU's.

II. 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.

Modbus messages may be one of two formats:

Modbus RTU message frame format:

Packet	CRC
N x 8 bits	16-bits

Packet: The packet field consists of the Modbus packet being sent or received. Packet format varies with the function being performed and the register group being accessed.

CRC: The error check field consists an 16 bit cyclic redundancy check calculated over the length of the packet field.

Modbus ASCII message frame format:

BOF	Packet	LRC	EOF	Ready
:	2 x Number of bytes in Modbus packet	8-bits	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'.)

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.

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

Note: *Total message frame length can not exceed 256 bytes.*

III. Totalflow Modbus Implementation

Totalflow Modbus supports RTU or ASCII mode. Support has also been added for long integer, floating point, and archive record registers. Totalflow Modbus supports the following subset of the Gould Modbus defined functions:

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
16	Set Multiple Register	Set multiple 16/32 bit registers
128-143	Exception Response	Used in FCU response packets to indicate errors in processing function codes 1-16.

♣ Available for use, but not implemented in Poll Group or Block PG&E protocols.

Packet formats:

Read Query

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

Read Response

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

Set Query

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

Set Response

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

Set Multiple Query

Address	Function	Register	Quantity	Byte Count	Data
8-bits	8-bits	16-bits	16-bits	8-bits	N x 8 bits

Set Multiple Response

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

Exception Response

Address	Function	Code
8-bits	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.

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.

Code: The code field contains an error value for the exception response. Currently there are three values used; 1 indicates that the function code is unsupported, 2 indicates the register number requested is invalid, 3 indicates that too many data values were requested and that the maximum packet size was exceeded. The maximum packet size for ASCII is 122 bytes and for RTU the maximum packet size is 250.

Quantity: The quantity field contains the number of consecutive registers to fetch or set. This field is not present in all packets (only read and set multiple queries).

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 and set multiple query).

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 data items is high to low (MSB first, LSB last).

IV. Register Group Configuration

Registers are grouped by data type. The grouping is fixed, but the base (or starting) register number of each group is configurable. The PG&E protocol introduces the concepts of Block and Poll Group transactions. Default register group assignments:

Default Base	Type	Description
100	INTEGER	Register Configuration for Poll Groups
500	INTEGER	Overall Configuration for PG&E
1001	BOOLEAN	1 Bit Boolean Group
3001	INTEGER	16 Bit Integer Group
5001	LONG INTEGER	32 Bit Long Integer Group
7001	FLOATING POINT	32 Bit IEEE Floating Point Group
8400	PGEHEAD	Signifies Header File Start for Block Operations
10001	RECORD	Daily Flow Archive Record Group
11001	RECORD	Log Period Flow Archive Record Group
12001	RECORD	Event Log Archive Record Group
15001	TLP	TLP Type PG&E Register Group
20001	PGEGROUP	Partition Table Containing Point Type Definitions
30001	PGESTRING	Partition Table Containing Point Type Strings
0 (Disabled)	FLOATING POINT	Configurable Read-only Floating Point Group

Group configuration registers are read using function code 03 and set using function code 16. It is also possible to set a register in the 1001 – 7001 groups using function code 06. To disable a register group, set the base register to zero (0).

V. Configurable Register Group

Registers 110-357 can be used to configure a custom floating point register group as follows:

- Define the register group by writing the fixed register numbers of the data items to be included in this register group into registers 111-357. Any of the Boolean, Integer, Long Integer, or Floating Point registers may be specified. The data from boolean, integer, and long integer registers will be converted to floating point before they are inserted into the response packet.

- Enable the register group by writing a base register number into register 110. This will be the starting register number of the custom register group.

An example follows this register group table.

Register	Access	Description
100	Read/Write	Configuration Group Base Register Number
101	Read/Write	Boolean Register Group Base Register Number
102	Read/Write	Integer Register Group Base Register Number
103	Read/Write	Long Register Group Base Register Number
104	Read/Write	Floating Point Register Group Base Register Number
105	Read/Write	Daily Flow Archive Register Group Base Register Number
106	Read/Write	Log Period Archive Register Group Base Register Number
107	Read/Write	Event Log Archive Register Group Base Register Number
110	Read/Write	Poll Group Base Register Number -- 8000
111	Read/Write	Configurable Register 1
112	Read/Write	Configurable Register 2
113	Read/Write	Configurable Register 3
114	Read/Write	Configurable Register 4
115	Read/Write	Configurable Register 5
116	Read/Write	Configurable Register 6
117	Read/Write	Configurable Register 7
118	Read/Write	Configurable Register 8
119	Read/Write	Configurable Register 9
120	Read/Write	Configurable Register 10
121	Read/Write	Configurable Register 11
122	Read/Write	Configurable Register 12
123	Read/Write	Configurable Register 13
124	Read/Write	Configurable Register 14
125	Read/Write	Configurable Register 15
126	Read/Write	Configurable Register 16
127	Read/Write	Configurable Register 17
128	Read/Write	Configurable Register 18
129	Read/Write	Configurable Register 19
130	Read/Write	Configurable Register 20
131	Read/Write	Configurable Register 21
132	Read/Write	Configurable Register 22
133	Read/Write	Configurable Register 23
134	Read/Write	Configurable Register 24
135	Read/Write	Configurable Register 25
136	Read/Write	Configurable Register 26
137	Read/Write	Configurable Register 27
138	Read/Write	Configurable Register 28
139	Read/Write	Configurable Register 29
140	Read/Write	Configurable Register 30
141	Read/Write	Configurable Register 31

Configurable Registers (cont.)

Register	Access	Description
142	Read/Write	Configurable Register 32
143	Read/Write	Configurable Register 33
144	Read/Write	Configurable Register 34
145	Read/Write	Configurable Register 35
146	Read/Write	Configurable Register 36
147	Read/Write	Configurable Register 37
148	Read/Write	Configurable Register 38
149	Read/Write	Configurable Register 39
150	Read/Write	Configurable Register 40
151	Read/Write	Configurable Register 41
152	Read/Write	Configurable Register 42
153	Read/Write	Configurable Register 43
154	Read/Write	Configurable Register 44
155	Read/Write	Configurable Register 45
156	Read/Write	Configurable Register 46
157	Read/Write	Configurable Register 47
158	Read/Write	Configurable Register 48
159	Read/Write	Configurable Register 49
160	Read/Write	Configurable Register 50
161	Read/Write	Configurable Register 51
162	Read/Write	Configurable Register 52
163	Read/Write	Configurable Register 53
164	Read/Write	Configurable Register 54
165	Read/Write	Configurable Register 55
166	Read/Write	Configurable Register 56
167	Read/Write	Configurable Register 57
168	Read/Write	Configurable Register 58
169	Read/Write	Configurable Register 59
170	Read/Write	Configurable Register 60
171	Read/Write	Configurable Register 61
172	Read/Write	Configurable Register 62
173	Read/Write	Configurable Register 63
174	Read/Write	Configurable Register 64
175	Read/Write	Configurable Register 65
176	Read/Write	Configurable Register 66
177	Read/Write	Configurable Register 67
178	Read/Write	Configurable Register 68
179	Read/Write	Configurable Register 69
180	Read/Write	Configurable Register 70
181	Read/Write	Configurable Register 71
182	Read/Write	Configurable Register 72
183	Read/Write	Configurable Register 73
184	Read/Write	Configurable Register 74
185	Read/Write	Configurable Register 75
186	Read/Write	Configurable Register 76
187	Read/Write	Configurable Register 77
188	Read/Write	Configurable Register 78
189	Read/Write	Configurable Register 79
190	Read/Write	Configurable Register 80
191	Read/Write	Configurable Register 81
192	Read/Write	Configurable Register 82

Configurable Registers (cont.)

Register	Access	Description
193	Read/Write	Configurable Register 83
194	Read/Write	Configurable Register 84
195	Read/Write	Configurable Register 85
196	Read/Write	Configurable Register 86
197	Read/Write	Configurable Register 87
198	Read/Write	Configurable Register 88
199	Read/Write	Configurable Register 89
200	Read/Write	Configurable Register 90
201	Read/Write	Configurable Register 91
202	Read/Write	Configurable Register 92
203	Read/Write	Configurable Register 93
204	Read/Write	Configurable Register 94
205	Read/Write	Configurable Register 95
206	Read/Write	Configurable Register 96
207	Read/Write	Configurable Register 97
208	Read/Write	Configurable Register 98
209	Read/Write	Configurable Register 99
210	Read/Write	Configurable Register 100
211	Read/Write	Configurable Register 101
212	Read/Write	Configurable Register 102
213	Read/Write	Configurable Register 103
214	Read/Write	Configurable Register 104
215	Read/Write	Configurable Register 105
216	Read/Write	Configurable Register 106
217	Read/Write	Configurable Register 107
218	Read/Write	Configurable Register 108
219	Read/Write	Configurable Register 109
220	Read/Write	Configurable Register 110
221	Read/Write	Configurable Register 111
222	Read/Write	Configurable Register 112
223	Read/Write	Configurable Register 113
224	Read/Write	Configurable Register 114
225	Read/Write	Configurable Register 115
226	Read/Write	Configurable Register 116
227	Read/Write	Configurable Register 117
228	Read/Write	Configurable Register 118
229	Read/Write	Configurable Register 119
230	Read/Write	Configurable Register 120
231	Read/Write	Configurable Register 121
232	Read/Write	Configurable Register 122
233	Read/Write	Configurable Register 123
234	Read/Write	Configurable Register 124
235	Read/Write	Configurable Register 125
236	Read/Write	Configurable Register 126
237	Read/Write	Configurable Register 127
238	Read/Write	Configurable Register 128
239	Read/Write	Configurable Register 129
240	Read/Write	Configurable Register 130
241	Read/Write	Configurable Register 131
242	Read/Write	Configurable Register 132
243	Read/Write	Configurable Register 133
244	Read/Write	Configurable Register 134

Configurable Registers (cont.)

Register	Access	Description
245	Read/Write	Configurable Register 135
246	Read/Write	Configurable Register 136
247	Read/Write	Configurable Register 137
248	Read/Write	Configurable Register 138
249	Read/Write	Configurable Register 139
250	Read/Write	Configurable Register 140
251	Read/Write	Configurable Register 141
252	Read/Write	Configurable Register 142
253	Read/Write	Configurable Register 143
254	Read/Write	Configurable Register 144
255	Read/Write	Configurable Register 145
256	Read/Write	Configurable Register 146
257	Read/Write	Configurable Register 147
258	Read/Write	Configurable Register 148
259	Read/Write	Configurable Register 149
260	Read/Write	Configurable Register 150
261	Read/Write	Configurable Register 151
262	Read/Write	Configurable Register 152
263	Read/Write	Configurable Register 153
264	Read/Write	Configurable Register 154
265	Read/Write	Configurable Register 155
266	Read/Write	Configurable Register 156
267	Read/Write	Configurable Register 157
268	Read/Write	Configurable Register 158
269	Read/Write	Configurable Register 159
270	Read/Write	Configurable Register 160
271	Read/Write	Configurable Register 161
271	Read/Write	Configurable Register 162
272	Read/Write	Configurable Register 163
273	Read/Write	Configurable Register 164
274	Read/Write	Configurable Register 165
275	Read/Write	Configurable Register 166
276	Read/Write	Configurable Register 167
277	Read/Write	Configurable Register 168
278	Read/Write	Configurable Register 169
279	Read/Write	Configurable Register 170
280	Read/Write	Configurable Register 171
281	Read/Write	Configurable Register 172
282	Read/Write	Configurable Register 173
283	Read/Write	Configurable Register 174
284	Read/Write	Configurable Register 175
285	Read/Write	Configurable Register 176
286	Read/Write	Configurable Register 177
287	Read/Write	Configurable Register 178
288	Read/Write	Configurable Register 179
289	Read/Write	Configurable Register 180
290	Read/Write	Configurable Register 181
291	Read/Write	Configurable Register 182
292	Read/Write	Configurable Register 183
293	Read/Write	Configurable Register 184
294	Read/Write	Configurable Register 185

Configurable Registers (cont.)

Register	Access	Description
295	Read/Write	Configurable Register 186
296	Read/Write	Configurable Register 187
297	Read/Write	Configurable Register 188
298	Read/Write	Configurable Register 189
299	Read/Write	Configurable Register 190
300	Read/Write	Configurable Register 191
301	Read/Write	Configurable Register 192
302	Read/Write	Configurable Register 193
303	Read/Write	Configurable Register 194
304	Read/Write	Configurable Register 195
305	Read/Write	Configurable Register 196
306	Read/Write	Configurable Register 197
307	Read/Write	Configurable Register 198
308	Read/Write	Configurable Register 199
309	Read/Write	Configurable Register 200
310	Read/Write	Configurable Register 201
311	Read/Write	Configurable Register 202
312	Read/Write	Configurable Register 203
313	Read/Write	Configurable Register 204
314	Read/Write	Configurable Register 205
315	Read/Write	Configurable Register 206
316	Read/Write	Configurable Register 207
317	Read/Write	Configurable Register 208
318	Read/Write	Configurable Register 209
319	Read/Write	Configurable Register 210
320	Read/Write	Configurable Register 211
321	Read/Write	Configurable Register 212
322	Read/Write	Configurable Register 213
323	Read/Write	Configurable Register 214
324	Read/Write	Configurable Register 215
325	Read/Write	Configurable Register 216
326	Read/Write	Configurable Register 217
327	Read/Write	Configurable Register 218
328	Read/Write	Configurable Register 219
329	Read/Write	Configurable Register 220
330	Read/Write	Configurable Register 221
331	Read/Write	Configurable Register 222
332	Read/Write	Configurable Register 223
333	Read/Write	Configurable Register 224
334	Read/Write	Configurable Register 225
335	Read/Write	Configurable Register 226
336	Read/Write	Configurable Register 227
337	Read/Write	Configurable Register 228
338	Read/Write	Configurable Register 229
339	Read/Write	Configurable Register 230
340	Read/Write	Configurable Register 231
341	Read/Write	Configurable Register 232
342	Read/Write	Configurable Register 233
343	Read/Write	Configurable Register 234
344	Read/Write	Configurable Register 235

Configurable Registers (cont.)

Register	Access	Description
345	Read/Write	Configurable Register 236
346	Read/Write	Configurable Register 237
347	Read/Write	Configurable Register 238
348	Read/Write	Configurable Register 239
349	Read/Write	Configurable Register 240
350	Read/Write	Configurable Register 241
351	Read/Write	Configurable Register 242
352	Read/Write	Configurable Register 243
353	Read/Write	Configurable Register 244
354	Read/Write	Configurable Register 245
355	Read/Write	Configurable Register 246
356	Read/Write	Configurable Register 247
357	Read/Write	Configurable Register 248

Example Custom Group Definition:

110 = 8001 (Starting register number of group)
111 = 0 (Null)
112 = 0 (Null)
113 = 7003 (Current SP)
114 = 7004 (Current DP)
115 = 7005 (Current TF)
116 = 7006 (Current Flow Rate)
117 = 7009 (Today's Accumulated Volume)
118 = 7022 (Previous Day's Volume)
119 = 7001 (Current Battery Voltage)
120 = 7002 (Current Charger Voltage)

Using the above group definition, a poll of registers 8001-8010 will return:

8001 = zero (0.0)
8002 = zero (0.0)
8003 = Current SP
8004 = Current DP
8005 = Current TF
8006 = Current Flow Rate
8007 = Today's Accumulated Volume
8008 = Previous Day's Volume
8009 = Current Battery Voltage
8010 = Current Charger Voltage

As shown in the example above, null (0) register entries are allowed. The response packet will be padded with zero (0.0) values for each null register polled. Attempts to write to null register entries will be ignored.

VI. Boolean Register Group

Boolean registers are read using function code 01 or set using function code 05. The base register number for this register group defaults to 1001 when the unit is cold started. It can be changed by setting register 101 to the desired starting register number of the group.

Register	Access	Description	Meter Type
1001	Read/Write	Use Sqrt /linear SP/DP avgs (1 = Sqrt)	Gas Orifice
1002	Read/Write	Use F(pb) (1985 Equation)	G.O. / Turbine
1003	Read/Write	Use F(tb) (1985 Equation)	G.O. / Turbine
1004	Read/Write	Use F(tf) (1985 Equation)	Gas Orifice
1005	Read/Write	Use F(g) (1985 Equation)	Gas Orifice
1006	Read/Write	Use F(a) (1985 Equation)	Gas Orifice
1007	Read/Write	Use F® (1985 Equation)	Gas Orifice
1008	Read/Write	Use Y (1985 Equation)	Gas Orifice
1009	Read/Write	Use F(w) (1985 Equation)	Gas Orifice
1010	Read/Write	Use F(pv) (1985 Equation)	Gas Orifice
1011	Read/Write	Use F(aux) (1985 Equation)	G.O. / Turbine
1012	Read/Write	Use F(b) (1985 Equation)	Gas Orifice
1013	Read/Write	Tap location (1985 Equation) (1 = Upstream)	Gas Orifice
1014	Read/Write	Orifice Type (0 = SS, 1 = Monel) (1985 Eq only)	Gas Orifice
1015	Read/Write	Use Y (1992 Equation)	Gas Orifice
1016	Read/Write	Use F(pv) (1992 Equation)	Gas Orifice
1017	Read/Write	Use F(w) (1992 Equation)	Gas Orifice
1018	Read/Write	Use F(aux) (1992 Equation)	Gas Orifice
1019	Read/Write	Tap location (1992 Equation)(1 = Upstream, 0 = Down)	Gas Orifice
1020	Read/Write	Use calc Cd / fixed Cd (1 = calc Cd) (1992 Equation)	Gas Orifice
1021	Read/Write	Tap Type Support (1 = supported) (1985 Equation)	Gas Orifice
1022	Read/Write	Tap type (1 = pipe, 0 = flange) (1985 Equation)	Gas Orifice
1023	Read/Write	RTD installed	G.O. / Turbine
1024	Read/Write	Temperature in calcs (1 = Measured, 0 = Fixed)	G.O. / Turbine
1025	Write Only	Reset volume	Gas Orifice
1026	Write Only	Reset Log Period	Gas Orifice
1027	Read/Write	Trip contact on Low Charger alarm	G.O. / Turbine
1028	Read/Write	Trip contact on DP low alarm	Gas Orifice
1029	Read/Write	Trip contact on DP high alarm	Gas Orifice
1030	Read/Write	Trip contact on SP low alarm	G.O. / Turbine
1031	Read/Write	Trip contact on SP high alarm	G.O. / Turbine
1032	Read/Write	Trip contact on Remote Sense	G.O. / Turbine
1033	Read/Write	Trip contact on volume setpoint	G.O. / Turbine
1034	Read/Write	Aux Contact Auto Reset (1 = yes)	G.O. / Turbine
1035	Read/Write	Auxiliary Contact State DO1 (0='ON' 1='OFF') Stays on for default time	Gas Orifice
1036	Read/Write	Hold Current Analog Inputs	Gas Orifice
1037	Read Only	Attached to stream (AIU support)	G.O. / Turbine
1038	Read Only	First analysis received (AIU support)	G.O. / Turbine
1039	Read/Write	Use Fixed Analysis on error (AIU support)	G.O. / Turbine
1040	Read/Write	Use Fixed Water Vapor Content	Gas Orifice
1041	Write Only	Wakeup FCU from low voltage induced sleep	Gas Orifice
1042	Read/Write	Use Fixed Test Mode SP, DP/PI, and RTD values.	Gas Orifice
1043	Read/Write	Use Measured SP	Turbine
1044	Read/Write	Use S (Fpv^2)	Turbine

Boolean Registers (cont.)

Register	Access	Description	Meter Type
1045	Read/Write	Trip contact on ACF low alarm	Turbine
1046	Read/Write	Trip contact on ACF high alarm	Turbine
1047	Read Only	Remote Sense Digital Input State(DI 1)	G.O. / Turbine
1048	Read Only	Digital Input 2	G.O. / Turbine
1049	Read/Write	Digital Output 2 (0='ON', 1='OFF') stays on for default time	G.O. / Turbine
1050	Read/Write	Trip DO 1 on TF Low Limit	G.O./ Turbine
1051	Read/Write	Trip DO 1 on TF High Limit	G.O./ Turbine
1052	Read/Write	Trip DO 1 on Flow Rate Low Limit	G.O./ Turbine
1053	Read/Write	Trip DO 1 on Flow Rate High Limit	G.O./ Turbine
1054	Read/Write	Trip DO 2 on Low Charger	G.O./ Turbine
1055	Read/Write	Trip DO 2 on DP(ACF) Low Limit	G.O./ Turbine
1056	Read/Write	Trip DO 2 on DP(ACF) High Limit	G.O./ Turbine
1057	Read/Write	Trip DO 2 on SP Low Limit	G.O./ Turbine
1058	Read/Write	Trip DO 2 on SP High Limit	G.O./ Turbine
1059	Read/Write	Trip DO 2 on Remote Sense	G.O./ Turbine
1060	Read/Write	Trip DO 2 on Volume Setpoint	G.O./ Turbine
1061	Read/Write	Auto Reset DO 2	G.O./ Turbine
1062	Read/Write	Trip DO 2 on TF Low Limit	G.O./ Turbine
1063	Read/Write	Trip DO 2 on TF High Limit	G.O./ Turbine
1064	Read/Write	Trip DO 2 on Flow Rate Low Limit	G.O./ Turbine
1065	Read/Write	Trip DO 2 on Flow Rate High Limit	G.O./ Turbine
1066-1115	Read/Write	User Configurable Registers	G.O./ Turbine
1116	Read/Write	Configure gravity for live analysis	G.O./ Turbine
1117	Read/Write	Fixed gravity value on error	G.O./ Turbine
1118	Read/Write	Configure heating value for live analysis	G.O./ Turbine
1119	Read/Write	Fixed heating value on error	G.O./ Turbine
1120	Read/Write	Configure CO2 for live analysis	G.O./ Turbine
1121	Read/Write	Fixed CO2 value on error	G.O./ Turbine
1122	Read/Write	Configure N2 for live analysis	G.O./ Turbine
1123	Read/Write	Fixed N2 value on error	G.O./ Turbine
1124	Read/Write	Configure Methane for live analysis	G.O./ Turbine
1125	Read/Write	Fixed Methane value on error	G.O./ Turbine
1126	Read/Write	Configure H2S for live analysis	G.O./ Turbine
1127	Read/Write	Fixed H2S on error	G.O./ Turbine
1128	Read/Write	Configure H2O for live analysis	G.O./ Turbine
1129	Read/Write	Fixed H2O on error	G.O./ Turbine
1130	Read/Write	Configure Helium for live analysis	G.O./ Turbine
1131	Read/Write	Fixed Helium value on error	G.O./ Turbine
1132	Read/Write	Configure C2 for live analysis	G.O./ Turbine
1133	Read/Write	Fixed C2 value on error	G.O./ Turbine
1134	Read/Write	Configure C3 for live analysis	G.O./ Turbine
1135	Read/Write	Fixed C3 value on error	G.O./ Turbine
1136	Read/Write	Configure IC4 for live analysis	G.O./ Turbine

Boolean Registers (cont.)

Register	Access	Description	Meter Type
1137	Read/Write	Fixed IC4 value on error	G.O./ Turbine
1138	Read/Write	Configure NC4 for live analysis	G.O./ Turbine
1139	Read/Write	Fixed NC4 value on error	G.O./ Turbine
1140	Read/Write	Configure IC5 for live analysis	G.O./ Turbine
1141	Read/Write	Fixed IC5 value on error	G.O./ Turbine
1142	Read/Write	Configure NC5 for live analysis	G.O./ Turbine
1143	Read/Write	Fixed NC5 value on error	G.O./ Turbine
1144	Read/Write	Configure NC6 for live analysis	G.O./ Turbine
1145	Read/Write	Fixed NC6 value on error	G.O./ Turbine
1146	Read/Write	Configure NC72 for live analysis	G.O./ Turbine
1147	Read/Write	Fixed NC7 value on error	G.O./ Turbine
1148	Read/Write	Configure NC8 for live analysis	G.O./ Turbine
1149	Read/Write	Fixed NC8 value on error	G.O./ Turbine
1150	Read/Write	Configure NC9 for live analysis	G.O./ Turbine
1151	Read/Write	Fixed NC9 on error	G.O./ Turbine
1152	Read/Write	Configure NC10 for live analysis	G.O./ Turbine
1153	Read/Write	Fixed NC10 on error	G.O./ Turbine
1154	Read/Write	Configure Oxygen for live analysis	G.O./ Turbine
1155	Read/Write	Fixed Oxygen value on error	G.O./ Turbine
1156	Read/Write	Configure CO for live analysis	G.O./ Turbine
1157	Read/Write	Fixed CO value on error	G.O./ Turbine
1158	Read/Write	Configure H2 for live analysis	G.O./ Turbine
1159	Read/Write	Fixed H2 value on error	G.O./ Turbine
1160	Read/Write	Configure Argon for live analysis	G.O./ Turbine
1161	Read/Write	Fixed Argon value on error	G.O./ Turbine
1162	Read	Security Switch	G.O./ Turbine
1163	Read	Low Lithium	G.O./ Turbine
1164	Read	DI 1*	G.O./ Turbine
1165	Read	RTC	G.O./ Turbine
1166	Read	DI 2*	G.O./ Turbine
1167	Read	Low Charger	G.O./ Turbine
1168	Read	Low Battery	G.O./ Turbine
1169	Read	Low Radio Battery	G.O./ Turbine
1170	Read	VCI DI 1*	G.O./ Turbine
1171	Read	VCI DI 2*	G.O./ Turbine
1172	Read	VCI DI 3*	G.O./ Turbine
1173	Read	VCI DI 4*	G.O./ Turbine
1174	Read/Write	VCI DO 1* (0='off' 1='on') (Stays on until turned off)	G.O./ Turbine
1175	Read/Write	VCI DO 2*	G.O./ Turbine
1176	Read/Write	VCI DO 3*	G.O./ Turbine
1177	Read/Write	VCI DO 4*	G.O./ Turbine
1178	Read/Write	DO 1*	G.O./ Turbine

Boolean Registers (cont.)

Register	Access	Description	Meter Type
1179	Read/Write	DO 2♣	G.O./ Turbine
1180	Read/Write	Remote Operation	G.O./ Turbine
1181	Read/Write	Aux Operation	G.O./ Turbine
1182	Read/Write	Bus Operation	G.O./ Turbine
1183-1190	Read/Write	User Configurable Registers	G.O./ Turbine
1191	Write	Reset PG&E Block Table to Factory Defaults	G.O./ Turbine
1192	Write	Reset PG&E Poll Group Config To Factory Defaults	G.O./ Turbine

♣ Available for use, but not accessed through Poll Groups or Block Operations in PG&E Protocol.

VII. Short Integer Register Group

Short integer registers are read using function code 03 and set using function code 06 or 16. The base register number for this register group defaults to 3001 when the unit is cold started. It can be changed by setting register 102 to the desired starting register number of the group.

Register	Access	Description	Meter Type
3001	Read Only	Primary element (1 = Turbine, 0 = Gas Orifice)	G.O. / Turbine
3002	Read Only	Primary element mask	G.O. / Turbine
3003	Read/Write	FCU volume calc. method (1 = 1985 eq., 2 = 1992 eq.)	G.O. / Turbine
3004	Read Only	FCU volume calc method mask	G.O. / Turbine
3005	Read Only	FCU calculation units	G.O. / Turbine
3006	Read Only	FCU calculation units mask	G.O. / Turbine
3007	Read/Write	Supercomp method (0 = NX19 Fixed, 1 = NX19 Auto, 2 = NX19 GCN, 3 = NX19 GCNM, 11 = AGA-8 Gross, 12 = AGA-8 Detail)	G.O. / Turbine
3008	Read Only	Supercomp method mask	G.O. / Turbine
3009	Read/Write	Contract Hour	G.O. / Turbine
3010	Read/Write	Volume calculation period in seconds (60, 120, 600, 1200, & 3600)	G.O. / Turbine
3011	Read/Write	Modbus Slave Address	G.O. / Turbine
3012	Read/Write	Remote Comm Baud (0=1200,1=2400,2=4800,3=9600)	G.O. / Turbine
3013	Read/Write	Remote Comm Data Bits (7 or 8)	G.O. / Turbine
3014	Read/Write	Remote Comm Parity (0 = None, 1 = Odd, 2 = Even)	G.O. / Turbine
3015	Read/Write	Remote Comm Stop Bits (1 or 2)	G.O. / Turbine
3016	Read/Write	Radio power up delay(milliseconds)	G.O. / Turbine
3017	Read/Write	Xmitter key delay(milliseconds)	G.O. / Turbine
3018	Read/Write	Xmitter unkey delay (milliseconds)	G.O. / Turbine
3019	Read/Write	Remote Comm Protocol (0 = Totalflow, 1 = Modbus)	G.O. / Turbine
3020	Read/Write	Remote Comm Link Establish Time (Totalflow Protocol)	G.O. / Turbine
3021	Read/Write	Maximum Number of Events	G.O. / Turbine
3022	Read/Write	Sequence Number of Last Event Logged	G.O. / Turbine
3023	Read/Write	Sequence Number of Last Event Read	G.O. / Turbine
3024	Read/Write	Sequence Number of Last Event Acknowledged	G.O. / Turbine
3025	Read/Write	Number of unacknowledged events	G.O. / Turbine
3026	Read/Write	Maximum Number of Log Period Records	G.O. / Turbine
3027	Read Only	Sequence Number of current Log Period Record	G.O. / Turbine
3028	Read/Write	Maximum Number of Day Period Records	G.O. / Turbine
3029	Read Only	Sequence Number of current Day Period Record	G.O. / Turbine
3030	Read Only	Sequence number of 1st Log Period Rec in current day	G.O. / Turbine
3031	Read/Write	Vol Period Counter	G.O. / Turbine
3032	Read/Write	FCU ID	G.O. / Turbine
3033	Read/Write	FCU ID (cont.)	G.O. / Turbine
3034	Read/Write	FCU ID (cont.)	G.O. / Turbine
3035	Read/Write	FCU ID (cont.)	G.O. / Turbine
3036	Read/Write	FCU ID (cont.)	G.O. / Turbine
3037	Read/Write	FCU Location	G.O. / Turbine
3038	Read/Write	FCU Location (cont.)	G.O. / Turbine
3039	Read/Write	FCU Location (cont.)	G.O. / Turbine
3040	Read/Write	FCU Location (cont.)	G.O. / Turbine
3041	Read/Write	FCU Location (cont.)	G.O. / Turbine
3042	Read/Write	FCU Location (cont.)	G.O. / Turbine
3043	Read/Write	FCU Location (cont.)	G.O. / Turbine
3044	Read/Write	FCU Location (cont.)	G.O. / Turbine
3045	Read/Write	FCU Location (cont.)	G.O. / Turbine

Short Integer Group (cont.)

Register	Access	Description	Meter Type
3046	Read/Write	FCU Location (cont.)	G.O. / Turbine
3047	Read/Write	FCU Location (cont.)	G.O. / Turbine
3048	Read/Write	FCU Location (cont.)	G.O. / Turbine
3049	Read/Write	Software Part Number	G.O. / Turbine
3050	Read/Write	Software Part Number (cont.)	G.O. / Turbine
3051	Read/Write	Software Part Number (cont.)	G.O. / Turbine
3052	Read/Write	Software Part Number (cont.)	G.O. / Turbine
3053	Read/Write	Software Part Number (cont.)	G.O. / Turbine
3054	Read/Write	Software Part Number (cont.)	G.O. / Turbine
3055	Read/Write	Software Part Name	G.O. / Turbine
3056	Read/Write	Software Part Name (cont.)	G.O. / Turbine
3057	Read/Write	Software Part Name (cont.)	G.O. / Turbine
3058	Read/Write	Software Part Name (cont.)	G.O. / Turbine
3059	Read/Write	Software Part Name (cont.)	G.O. / Turbine
3060	Read/Write	Software Part Name (cont.)	G.O. / Turbine
3061	Read/Write	Software Part Name (cont.)	G.O. / Turbine
3062	Read/Write	Software Part Name (cont.)	G.O. / Turbine
3063	Read/Write	Software Part Name (cont.)	G.O. / Turbine
3064	Read/Write	Software Part Name (cont.)	G.O. / Turbine
3065	Read/Write	Software Part Name (cont.)	G.O. / Turbine
3066	Read/Write	Software Part Name (cont.)	G.O. / Turbine
3067	Read/Write	Software Revision	G.O. / Turbine
3068	Read/Write	Software Revision (cont.)	G.O. / Turbine
3069	Read Only	Flow Window Period In Seconds (1, 2, 5, 10, 15, 20, 30, & 60) (60 - 3600 in 60 sec. intervals)	Turbine
3070	Read/Write	Modbus Group Address	G.O. / Turbine
3071	Read/Write	Current Group Select	G.O. / Turbine
3072	Read/Write	Remote Port Listen Interval Timeout (Seconds)	G.O. / Turbine
3073	Read/Write	Local Port Listen Interval Timeout (Seconds)	G.O. / Turbine
3074	Read/Write	Aux Port Listen Interval Timeout (Seconds)	G.O. / Turbine
3075	Read/Write	Current Analog Input Number (0-6)	G.O. / Turbine
3076-3095	Read/Write	General purpose user registers	G.O. / Turbine
3096	Read/Write	Valve Control Interface Feature Flag Word 1	G.O. / Turbine
3097	Read/Write	Valve Control Interface Feature Flag Word 2	G.O. / Turbine
3098	Read/Write	Valve Control Command Word 1	G.O. / Turbine
3099	Read/Write	Valve Control Command Word 2	G.O. / Turbine
3100	Read/Write	Valve Control Status Word 1	G.O. / Turbine
3101	Read/Write	Valve Control Status Word 2	G.O. / Turbine
3102	Read/Write	Valve Control DP Gain	G.O. / Turbine
3103	Read/Write	Valve Control SP Gain	G.O. / Turbine
3104	Read/Write	Valve Control FR Gain	G.O. / Turbine
3105	Read/Write	Valve Control Command Extension Word	G.O. / Turbine
3106	Read/Write	Valve Control Manual Pulse Width	G.O. / Turbine
3107	Read/Write	Valve Control Calculated Pulse Width	G.O. / Turbine
3108	Read/Write	Valve Control DP Low Override Delay	G.O. / Turbine
3109	Read/Write	Valve Control Intermitter On Duration	G.O. / Turbine
3110	Read/Write	Valve Control Intermitter Off Duration	G.O. / Turbine
3111	Read/Write	Valve Control Intermitter On Remaining	G.O. / Turbine
3112	Read/Write	Valve Control Intermitter Off Remaining	G.O. / Turbine
3113	Read/Write	Valve Control Shut-In Close Duration	G.O. / Turbine
3114	Read/Write	Valve Control Shut-In Close Remaining	G.O. / Turbine
3115	Read/Write	Number of live analysis components	G.O. / Turbine

Short Integer Group (cont.)

Register	Access	Description	Meter Type
3116	Read/Write	Live analysis component update period in seconds	G.O. / Turbine
3117-3135	Read/Write	User configurable registers	G.O. / Turbine
3136	Read/Write	Remote Port Comm Schedule	G.O. / Turbine
3137	Read/Write	Remote Port Comm Hour	G.O. / Turbine
3138	Read/Write	Remote Port Comm Min	G.O. / Turbine
3139	Read/Write	Remote Port Comm Duration	G.O. / Turbine
3140	Read/Write	Remote Port Comm Schedule Status	G.O. / Turbine
3141	Read/Write	Remote Port Comm Interval	G.O. / Turbine
3142	Read/Write	Remote Port Comm Off Hour	G.O. / Turbine
3143	Read/Write	Remote Port Comm Exception Retry	G.O. / Turbine
3144	Read/Write	AUX Port Comm Schedule	G.O. / Turbine
3145	Read/Write	AUX Port Comm Hour	G.O. / Turbine
3146	Read/Write	AUX Port Comm Min	G.O. / Turbine
3147	Read/Write	AUX Port Comm Duration	G.O. / Turbine
3148	Read/Write	AUX Port Comm Schedule Status	G.O. / Turbine
3149	Read/Write	AUX Port Comm Interval	G.O. / Turbine
3150	Read/Write	AUX Port Comm Off Hour	G.O. / Turbine
3151	Read/Write	AUX Port Comm Exception Retry	G.O. / Turbine
3152	Read/Write	AUXB Port Comm Schedule	G.O. / Turbine
3153	Read/Write	AUXB Port Comm Hour	G.O. / Turbine
3154	Read/Write	AUXB Port Comm Min	G.O. / Turbine
3155	Read/Write	AUXB Port Comm Duration	G.O. / Turbine
3156	Read/Write	AUXB Port Comm Schedule Status	G.O. / Turbine
3157	Read/Write	AUXB Port Comm Interval	G.O. / Turbine
3158	Read/Write	AUXB Port Comm Off Hour	G.O. / Turbine
3159	Read/Write	AUXB Port Comm Exception Retry	G.O. / Turbine
3160-3162	Read/Write	User configurable registers	G.O. / Turbine
3163	Read/Write	AUX Port Baudrate	G.O. / Turbine
3164	Read/Write	AUX Port Data Bits	G.O. / Turbine
3165	Read/Write	AUX Port Parity	G.O. / Turbine
3166	Read/Write	AUX Port Stop Bits	G.O. / Turbine
3167	Read/Write	AUX Port Radio Power Up Delay (milliseconds)	G.O. / Turbine
3168	Read/Write	AUX Port Xmitter Key Delay	G.O. / Turbine
3169	Read/Write	AUX Port Xmitter Un-Key Delay	G.O. / Turbine
3170	Read/Write	AUX Port Comm Protocol	G.O. / Turbine
3171	Read/Write	AUX Port Comm Link Establish Time	G.O. / Turbine
3172	Read/Write	AUXB Port Baudrate	G.O. / Turbine
3173	Read/Write	AUX B Port Data Bits	G.O. / Turbine
3174	Read/Write	AUX B Port Parity	G.O. / Turbine
3175	Read/Write	AUX B Port Stop Bits	G.O. / Turbine
3176	Read/Write	AUX B Port Radio Power Up Delay (milliseconds)	G.O. / Turbine
3177	Read/Write	AUX B Port Xmitter Key Delay	G.O. / Turbine
3178	Read/Write	AUX B Port Xmitter Un-Key Delay	G.O. / Turbine
3179	Read/Write	AUX B Port Comm Protocol	G.O. / Turbine
3180	Read/Write	AUX B Port Comm Link Establish Time	G.O. / Turbine
3181	Read/Write	Remote Port Interface	G.O. / Turbine
3182	Read/Write	AUX Port Interface	G.O. / Turbine
3183	Read/Write	AUXB Port Interface	G.O. / Turbine
3184	Read Only	PG&E NULL Character Register	G.O. / Turbine
3185	Read Only	PG&E NULL ASCII Register	G.O. / Turbine
3186	Read Only	PG&E NULL Integer Register	G.O. / Turbine

Short Integer Group (cont.)

Register	Access	Description	Meter Type
3187	Read Only	PG&E NULL Binary Register	G.O. / Turbine
3188	Read/Write	PG&E DO 1 (0=Default of 15 sec, any other value is time to stay on)	G.O. / Turbine
3189	Read/Write	PG&E DO 2 (0=Default of 15 sec, any other value is time to stay on)	G.O. / Turbine
3190	Read/Write	PG&E VCI DO 1 (0=Default of 15 sec, any other value is time to stay on)	G.O. / Turbine
3191	Read/Write	PG&E VCI DO 2 (0=Default of 15 sec, any other value is time to stay on)	G.O. / Turbine
3192	Read/Write	PG&E VCI DO 3 (0=Default of 15 sec, any other value is time to stay on)	G.O. / Turbine
3193	Read/Write	PG&E VCI DO 4 (0=Default of 15 sec, any other value is time to stay on)	G.O. / Turbine
3194	Read/Write	PG&E RTS DO (only 1 DO may be selected per port)	G.O. / Turbine
3195	Read/Write	Month	G.O. / Turbine
3196	Read/Write	Day	G.O. / Turbine
3197	Read/Write	Year	G.O. / Turbine
3198	Read/Write	Hour	G.O. / Turbine
3199	Read/Write	Minutes	G.O. / Turbine
3200	Read/Write	Seconds	G.O. / Turbine
3201	Read Only	Day of Week	G.O. / Turbine
3202	Read/Write	PG&E Date/Time 6 byte Register	G.O. / Turbine
3203	Read Only	DI 1 Status for Block Protocol	G.O. / Turbine
3204	Read Only	DI 2 Status for Block Protocol	G.O. / Turbine
3205	Read Only	VCI DI 1 Status for Block Protocol	G.O. / Turbine
3206	Read Only	VCI DI 2 Status for Block Protocol	G.O. / Turbine
3207	Read Only	VCI DI 3 Status for Block Protocol	G.O. / Turbine
3208	Read Only	VCI DI 4 Status for Block Protocol	G.O. / Turbine
3209	Read Only	DO 1 Status for Block Protocol	G.O. / Turbine
3210	Read Only	DO 2 Status for Block Protocol	G.O. / Turbine
3211	Read Only	VCI DO 1 Status for Block Protocol	G.O. / Turbine
3212	Read Only	VCI DO 2 Status for Block Protocol	G.O. / Turbine
3213	Read Only	VCI DO 3 Status for Block Protocol	G.O. / Turbine
3214	Read Only	VCI DO 4 Status for Block Protocol	G.O. / Turbine
3215	Read Only	Host Type ('R' = RTU, 'A'=ASCII) (Port Specific)	G.O. / Turbine
3216	Read/Write	Analog Valve Control Reverse Acting	G.O. / Turbine
3217	Read/Write	PG&E Analog Valve Loop Period (msecs)	G.O. / Turbine
3218	Read/Write	Analog Output for Valve Control	G.O. / Turbine
3219	Read Only	PG&E Analog Valve Control Status	G.O / Turbine
3220	Read/Write	PG&E Valve Minimum Control Time	G.O. / Turbine
3221	Read Only	Analog output 1 Low Cal Point	G.O / Turbine
3222	Read Only	Analog output 1 High Cal Point	G.O. / Turbine
3223	Read Only	Analog output 2 Low Cal Point	G.O. / Turbine
3224	Read Only	Analog output 2 High Cal Point	G.O. / Turbine
3225	Read Only	Analog output 3 Low Cal Point	G.O. / Turbine
3226	Read Only	Analog output 3 High Cal Point	G.O. / Turbine
3227	Read Only	Analog output 4 Low Cal Point	G.O. / Turbine
3228	Read Only	Analog output 4 High Cal Point	G.O. / Turbine
3229	Read/Write	Analog Output 1 Mode	G.O. / Turbine
3230	Read/Write	Analog Output 2 Mode	G.O / Turbine
3231	Read/Write	Analog Output 3 Mode	G.O. / Turbine
3232	Read/Write	Analog Output 4 Mode	G.O / Turbine
3233	Read/Write	AuxB Port Listen Interval Timeout	G.O. / Turbine

VIII. Long Integer Register Group

Long integer registers are read using function code 03 and set using function code 06 or 16. The base register number for this register group defaults to 5001 when the unit is cold started. It can be changed by setting register 103 to the desired starting register number of the group.

Register	Access	Description	Meter Type
5001 / 5001	Read/Write	Date / Time (Julian - # seconds since 00:00:00 1/1/70)	G.O. / Turbine
5002 / 5003	Read/Write	Volume Log period	G.O. / Turbine
5003 / 5005	Read Only	Log Period Counter	G.O. / Turbine
5004 /5007	Read Only	Log Period Start Date/Time	G.O. / Turbine
5005 / 5009	Read Only	Day Period Start Date/Time	G.O. / Turbine
5006 / 5011	Read Only	AIU Date/Time	G.O. / Turbine
5007 / 5013	Read Only	AIU Stream ID	G.O. / Turbine
5008 / 5015	Read/Write	Modbus Security Seed	G.O. / Turbine
5009 / 5017	Read Only	Extended Feature Flags	G.O. / Turbine
5010 / 5019	Read Only	Cold Start Date	G.O. / Turbine
5011 / 5021	Read Only	Total RAM size	G.O. / Turbine
5012 / 5023	Read Only	Total Banked RAM size	G.O. / Turbine
5013 / 5025	Read Only	Total Free Banked RAM	G.O. / Turbine
5014 / 5027	Read Only	Last calc Period Int. Range	G.O. / Turbine
5015 / 5029	Read Only	Last calc Period Int. Counts	G.O. / Turbine
5016 / 5031	Read Only	Last calc Period Alarms	G.O. / Turbine
5017 / 5033	Read/Write	PI 1 Accumulated Counts	G.O. / Turbine
5018 / 5035	Read/Write	PI 2 Accumulated Counts	G.O. / Turbine
5019 / 5037	Read Only	PI 1 Current Counts (1 second reading)	G.O. / Turbine
5020 / 5039	Read Only	PI 2 Current Counts (1 second reading)	G.O. / Turbine
5021	Read Only	Extended Feature Flags 2	G.O. / Turbine
5022-5025	Read Only	Null Registers	G.O. / Turbine
5026	Read Only	PG&E NULL Long Integer Register	G.O. / Turbine
5027	Read Only	Poll Group Alarm Status Register 1	G.O. / Turbine
5028	Read Only	Poll Group Alarm Status Register 2	G.O. / Turbine
5029	Read Only	Poll Group DI Status	G.O. / Turbine
5030	Read/Write	Poll Group DO Status and Set Register	G.O. / Turbine

IX. Floating Point Register Group

Floating point registers are read using function code 03 and set using function code 06 or 16. The base register number for this register group defaults to 7001 when the unit is cold started. It can be changed by setting register 104 to the desired starting register number of the group.

Register	Access	Description	Meter Type
7001 / 7001	Read Only	Current battery voltage	G.O. / Turbine
7002 / 7003	Read Only	Current charger voltage	G.O. / Turbine
7003 / 7005	Read Only	Current SP	G.O. / Turbine
7004 / 7007	Read Only	Current DP	Gas Orifice
7005 / 7009	Read Only	Current Temp	G.O. / Turbine
7006 / 7011	Read Only	Current flow rate (MCF/Hour)	G.O. / Turbine
7007 / 7013	Read Only	Current energy rate (MMBTU/Hour)	G.O. / Turbine
7008 / 7015	Read Only	Accumulated volume (MCF)	G.O. / Turbine
7009 / 7017	Read Only	Accumulated Volume since start of contract day (MCF)	G.O. / Turbine
7010 / 7019	Read Only	Previous Hour diff. pressure	Gas Orifice
7011 / 7021	Read Only	Previous Hour abs. pressure	G.O. / Turbine
7012 / 7023	Read Only	Previous Hour flowing temp	G.O. / Turbine
7013 / 7025	Read Only	Previous Hour extension	Gas Orifice
7014 / 7027	Read Only	Previous Hour volume (MCF)	G.O. / Turbine
7015 / 7029	Read Only	Previous Hour energy (MMBTU)	G.O. / Turbine
7016 / 7031	Read Only	Previous Hour Flow Time (MMMM.SS)	G.O. / Turbine
7017 / 7033	Read Only	Previous Hour Time (MMMM.SS)	G.O. / Turbine
7018 / 7035	Read Only	Previous Day diff. pressure	Gas Orifice
7019 / 7037	Read Only	Previous Day abs. pressure	G.O. / Turbine
7020 / 7039	Read Only	Previous Day flowing temp	G.O. / Turbine
7021 / 7041	Read Only	Previous Day Extension	Gas Orifice
7022 / 7043	Read Only	Previous Day volume (MCF)	G.O. / Turbine
7023 / 7045	Read Only	Previous Day energy (MMBTU)	G.O. / Turbine
7024 / 7047	Read Only	Previous Day Flow Time (MMMM.SS)	G.O. / Turbine
7025 / 7049	Read Only	Previous Day Time (MMMM.SS)	G.O. / Turbine
7026 / 7051	Read/Write	Fixed Analysis BTU	G.O. / Turbine
7027 / 7053	Read/Write	Fixed Analysis Gravity	G.O. / Turbine
7028 / 7055	Read/Write	Fixed Analysis CO2	G.O. / Turbine
7029 / 7057	Read/Write	Fixed Analysis N2	G.O. / Turbine
7030 / 7059	Read/Write	Fixed Analysis Methane	G.O. / Turbine
7031 / 7061	Read/Write	Fixed Analysis Ethane	G.O. / Turbine
7032 / 7063	Read/Write	Fixed Analysis Propane	G.O. / Turbine
7033 / 7065	Read/Write	Fixed Analysis IButane	G.O. / Turbine
7034 / 7067	Read/Write	Fixed Analysis NButane	G.O. / Turbine
7035 / 7069	Read/Write	Fixed Analysis IPentane	G.O. / Turbine
7036 / 7071	Read/Write	Fixed Analysis NPentane	G.O. / Turbine
7037 / 7073	Read/Write	Fixed Analysis NHexane	G.O. / Turbine
7038 / 7075	Read/Write	Fixed Analysis NHeptane	G.O. / Turbine
7039 / 7077	Read/Write	Fixed Analysis NOctane	G.O. / Turbine
7040 / 7079	Read/Write	Fixed Analysis NNonane	G.O. / Turbine
7041 / 7081	Read/Write	Fixed Analysis H2S	G.O. / Turbine
7042 / 7083	Read/Write	Fixed Analysis Hydrogen	G.O. / Turbine
7043 / 7085	Read/Write	Fixed Analysis Helium	G.O. / Turbine
7044 / 7087	Read/Write	Fixed Analysis Oxygen	G.O. / Turbine
7045 / 7089	Read/Write	Fixed Analysis Carbon Monoxide	G.O. / Turbine
7046 / 7091	Read/Write	Fixed Analysis Argon	G.O. / Turbine
7047 / 7093	Read/Write	Fixed Analysis NDecane	G.O. / Turbine

Floating Point (cont.)

Register	Access	Description	Meter Type
7048 / 7095	Read/Write	Fixed Analysis H2O	G.O. / Turbine
7049 / 7097	Read/Write	Fixed temperature	G.O. / Turbine
7050 / 7099	Read/Write	Temperature bias	G.O. / Turbine
7051 / 7101	Read/Write	Temperature base	G.O. / Turbine
7052 / 7103	Read/Write	Pressure base	G.O. / Turbine
7053 / 7105	Read/Write	Ratio of specific heats	G.O. / Turbine
7054 / 7107	Read/Write	Viscosity	G.O. / Turbine
7055 / 7109	Read/Write	Fixed F(b) (1985 Equation)	Gas Orifice
7056 / 7111	Read/Write	Fixed Cd (1992 Equation)	Gas Orifice
7057 / 7113	Read/Write	Fixed F(aux)	G.O. / Turbine
7058 / 7115	Read/Write	Fixed F(t) for NX19	G.O. / Turbine
7059 / 7117	Read/Write	Fixed F(p) for NX19	G.O. / Turbine
7060 / 7119	Read/Write	Zba – Z of air at base (1992 Equation)	Gas Orifice
7061 / 7121	Read/Write	Orifice diameter	Gas Orifice
7062 / 7123	Read/Write	Orifice plate coef. Of expansion (1992 Equation)	Gas Orifice
7063 / 7125	Read/Write	Pipe diameter	Gas Orifice
7064 / 7127	Read/Write	Pipe coef. Of expansion (1992 Equation)	Gas Orifice
7065 / 7129	Read/Write	Fixed barometric pressure	G.O. / Turbine
7066 / 7131	Read/Write	Fixed Water Vapor Content (LBS/MMSCF)	Gas Orifice
7067 / 7133	Read/Write	Water Content Bias (LBS/MMSCF)	Gas Orifice
7068 / 7135	Read Only	Last Calc Period diff. Pressure	Gas Orifice
7069 / 7137	Read Only	Last Calc Period abs. Pressure	G.O. / Turbine
7070 / 7139	Read Only	Last Calc Period flowing temp	G.O. / Turbine
7071 / 7141	Read Only	Last Calc Period volume (MCF)	G.O. / Turbine
7072 / 7143	Read Only	Last Calc Period Extension	Gas Orifice
7073 / 7145	Read Only	Last Calc Period C’	G.O. / Turbine
7074 / 7147	Read Only	Last Calc Period Y	Gas Orifice
7075 / 7149	Read Only	Last Calc Period F(pv)	Gas Orifice
7076 / 7151	Read Only	Last Calc Period F(w)	Gas Orifice
7077 / 7153	Read Only	Last Calc Period F(aux)	Gas Orifice
7078 / 7155	Read Only	Last Calc Period Qv	Gas Orifice
7079 / 7157	Read Only	Last Calc Period F(b)	Gas Orifice
7080 / 7159	Read Only	Last Calc Period F®	Gas Orifice
7081 / 7161	Read Only	Last Calc Period F(pb)	G.O. / Turbine
7082 / 7163	Read Only	Last Calc Period F(tb)	G.O. / Turbine
7083 / 7165	Read Only	Last Calc Period F(tf)	Gas Orifice
7084 / 7167	Read Only	Last Calc Period F(g)	Gas Orifice
7085 / 7169	Read Only	Last Calc Period F(a)	Gas Orifice
7086 / 7171	Read Only	Last Calc Period Fip	Gas Orifice
7087 / 7173	Read Only	Last Calc Period Ev	Gas Orifice
7088 / 7175	Read Only	Last Calc Period Orif Diameter	Gas Orifice
7089 / 7177	Read Only	Last Calc Period Pipe Diameter	Gas Orifice
7090 / 7179	Read Only	Last Calc Period Rhob	Gas Orifice
7091 / 7181	Read Only	Last Calc Period qm	Gas Orifice
7092 / 7183	Read Only	Last Calc Period Cd	Gas Orifice
7093 / 7185	Read Only	Last Calc Analysis BTU	G.O. / Turbine
7094 / 7187	Read Only	Last Calc Analysis Gravity	G.O. / Turbine
7095 / 7189	Read Only	Last Calc Analysis CO2	G.O. / Turbine
7096 / 7191	Read Only	Last Calc Analysis N2	G.O. / Turbine
7097 / 7193	Read Only	Last Calc Analysis Methane	G.O. / Turbine
7098 / 7195	Read Only	Last Calc Analysis Ethane	G.O. / Turbine
7099 / 7197	Read Only	Last Calc Analysis Propane	G.O. / Turbine

Floating Point (cont.)

Register	Access	Description	Meter Type
7100 / 7199	Read Only	Last Calc Analysis Ibutane	G.O. / Turbine
7101 / 7201	Read Only	Last Calc Analysis Nbutane	G.O. / Turbine
7102 / 7203	Read Only	Last Calc Analysis Ipentane	G.O. / Turbine
7103 / 7205	Read Only	Last Calc Analysis Npentane	G.O. / Turbine
7104 / 7207	Read Only	Last Calc Analysis Nhexane	G.O. / Turbine
7105 / 7209	Read Only	Last Calc Analysis Nheptane	G.O. / Turbine
7106 / 7211	Read Only	Last Calc Analysis Noctane	G.O. / Turbine
7107 / 7213	Read Only	Last Calc Analysis Nnonane	G.O. / Turbine
7108 / 7215	Read Only	Last Calc Analysis H2S	G.O. / Turbine
7109 / 7217	Read Only	Last Calc Analysis Hydrogen	G.O. / Turbine
7110 / 7219	Read Only	Last Calc Analysis Helium	G.O. / Turbine
7111 / 7221	Read Only	Last Calc Analysis Oxygen	G.O. / Turbine
7112 / 7223	Read Only	Last Calc Analysis Carbon Monoxide	G.O. / Turbine
7113 / 7225	Read Only	Last Calc Analysis Argon	G.O. / Turbine
7114 / 7227	Read Only	Last Calc Analysis Ndecane	G.O. / Turbine
7115 / 7229	Read Only	Last Calc Analysis H2O	G.O. / Turbine
7116 / 7231	Read/Write	DP Zero cutoff	Gas Orifice
7117 / 7233	Read/Write	DP low limit	Gas Orifice
7118 / 7235	Read/Write	DP hi limit	Gas Orifice
7119 / 7237	Read/Write	SP lo limit	G.O. / Turbine
7120 / 7239	Read/Write	SP hi limit	G.O. / Turbine
7121 / 7241	Read/Write	Tf low limit	G.O. / Turbine
7122 / 7243	Read/Write	Tf high limit	G.O. / Turbine
7123 / 7245	Read/Write	Flow Rate low limit	G.O. / Turbine
7124 / 7247	Read/Write	Flow Rate high limit	G.O. / Turbine
7125 / 7249	Read/Write	Volume Set Point for contact	G.O. / Turbine
7126 / 7251	Read Only	Accumulated Volume Rollover Setpoint	G.O. / Turbine
7127 / 7253	Read/Write	Places User Site Code in Event Log	G.O. / Turbine
7128 / 7255	Read Only	SP low calibration	G.O. / Turbine
7129 / 7257	Read Only	SP mid calibration	G.O. / Turbine
7130 / 7259	Read Only	SP high calibration	G.O. / Turbine
7131 / 7261	Read Only	DP lo calibration	Gas Orifice
7132 / 7263	Read Only	DP mid calibration	Gas Orifice
7133 / 7265	Read Only	DP high calibration	Gas Orifice
7134 / 7267	Read Only	Current Unfiltered Temp	G.O. / Turbine
7135 / 7269	Read Only	Current Unfiltered SP	G.O. / Turbine
7136 / 7271	Read Only	Current Unfiltered DP	Gas Orifice
7137 / 7273	Read Only	Current Pulse Count * Meter Factor	G.O. / Turbine
7138 / 7275	Read Only	Test Mode Fixed RTD Input Value	G.O. / Turbine
7139 / 7277	Read Only	Test Mode Fixed SP Input Value	G.O. / Turbine
7140 / 7279	Read Only	Test Mode Fixed DP/PI Input Value	G.O. / Turbine
7141 / 7281	Read Only	Previous Vol Period Pulse Count	Turbine
7142 / 7283	Read Only	Current Uncorrected Flow Rate	Turbine
7143 / 7285	Read Only	Uncorrected Accumulated Volume	Turbine
7144 / 7287	Read Only	Yesterday's Uncorrected Volume	Turbine
7145 / 7289	Read Only	Last Calc Period Uncorrected Volume	Turbine
7146 / 7291	Read Only	Last Calc Period S (Fpv^2)	Turbine
7147 / 7293	Read Only	Fixed SP	Turbine
7148 / 7295	Read Only	ACF high limit	Turbine
7149 / 7297	Read Only	ACF low limit	Turbine
7150 / 7299	Read Only	Meter Factor	Turbine
7151 / 7301	Read Only	Accumulated Energy	(G.O. / Turbine)

Floating Point (cont.)

Register	Access	Description	Meter Type
7152 / 7303	Read Only	Contract Day Accumulated Energy	(G.O. / Turbine)
7153 / 7305	Read Only	Prev Contract Day Accum Energy	(G.O. / Turbine)
7154 / 7307	Read Only	Prev Contract Day Accum Volume	(G.O. / Turbine)
7155 / 7309	Read Only	AI 1 scaled value	(G.O. / Turbine)
7156 / 7311	Read Only	AI 2 scaled value	(G.O. / Turbine)
7157 / 7313	Read Only	AI 1 ratio value	(G.O. / Turbine)
7158 / 7315	Read Only	AI 2 ratio value	(G.O. / Turbine)
7159 / 7317	Read/Write	PI 1 K factor	(G.O. / Turbine)
7160 / 7319	Read/Write	PI 2 K factor	(G.O. / Turbine)
7161 / 7321	Read Only	PI 1 Accum Conract Day Value	(G.O. / Turbine)
7162 / 7323	Read Only	PI 2 Accum Contract Day Value	(G.O. / Turbine)
7163 / 7325	Read Only	PI 1 Prev Contract Day Value	(G.O. / Turbine)
7164 / 7327	Read Only	PI 2 Prev Contract Day Value	(G.O. / Turbine)
7165 / 7329	Read Only	Current PI 1 Value	(G.O. / Turbine)
7166 / 7331	Read Only	Current PI 2 Value	(G.O. / Turbine)
7167 / 7333	Read/Write	Calibrate selected analog input	(G.O. / Turbine)
7168 / 7335	Read/Write	Selected analog input mid hi cal units	(G.O. / Turbine)
7169 / 7337	Read/Write	Selected analog input mid lo cal units	(G.O. / Turbine)
7170 / 7339	Read/Write	Selected analog input high cal units	(G.O. / Turbine)
7171 / 7341	Read/Write	Selected analog input mid cal units	(G.O. / Turbine)
7172 / 7343	Read/Write	Selected analog input low cal units	(G.O. / Turbine)
7173-7223	Read/Write	General purpose user registers	(G.O. / Turbine)
7224 / 7447	Read/Write	Valve Control SP Bias	(G.O. / Turbine)
7225 / 7449	Read/Write	Valve Control DP High	(G.O. / Turbine)
7226 / 7451	Read/Write	Valve Control DP Low	(G.O. / Turbine)
7227 / 7453	Read/Write	Valve Control DP Setpoint	(G.O. / Turbine)
7228 / 7455	Read/Write	Valve Control DP Dead Band	(G.O. / Turbine)
7229 / 7457	Read/Write	Valve Control Pipe Length	(G.O. / Turbine)
7230 / 7459	Read/Write	Valve Control SP High	(G.O. / Turbine)
7231 / 7461	Read/Write	Valve Control SP Low	(G.O. / Turbine)
7232 / 7463	Read/Write	Valve Control SP Setpoint	(G.O. / Turbine)
7233 / 7465	Read/Write	Valve Control SP Dead Band	(G.O. / Turbine)
7234 / 7467	Read/Write	Valve Control Pipe ID	(G.O. / Turbine)
7235 / 7469	Read/Write	Valve Control FR High	(G.O. / Turbine)
7236 / 7471	Read/Write	Valve Control FR Low	(G.O. / Turbine)
7237 / 7473	Read/Write	Valve Control FR Setpoint	(G.O. / Turbine)
7238 / 7475	Read/Write	Valve Control FR Dead Band	(G.O. / Turbine)
7239 / 7477	Read/Write	Valve Control Battery Voltage	(G.O. / Turbine)
7240 / 7479	Read/Write	Valve Control SP Override	(G.O. / Turbine)
7241 / 7481	Read/Write	Valve Control SP Restart	(G.O. / Turbine)
7242 / 7483	Read/Write	Live Analysis Gravity	G.O. / Turbine
7243 / 7485	Read/Write	Live Analysis BTU	G.O. / Turbine
7244 / 7487	Read/Write	Live Analysis CO2	G.O. / Turbine
7245 / 7489	Read/Write	Live Analysis N2	G.O. / Turbine
7246 / 7491	Read/Write	Live Analysis Methane	G.O. / Turbine
7247 / 7493	Read/Write	Live Analysis H2S	G.O. / Turbine
7248 / 7495	Read/Write	Live Analysis H2O	G.O. / Turbine
7249 / 7497	Read/Write	Live Analysis Helium	G.O. / Turbine
7250 / 7499	Read/Write	Live Analysis Ethane	G.O. / Turbine
7251 / 7501	Read/Write	Live Analysis Propane	G.O. / Turbine
7252 / 7503	Read/Write	Live Analysis Ibutane	G.O. / Turbine
7253 / 7505	Read/Write	Live Analysis Nbutane	G.O. / Turbine

Floating Point (cont.)

Register	Access	Description	Meter Type
7254 / 7507	Read/Write	Live Analysis Ipentane	G.O. / Turbine
7255 / 7509	Read/Write	Live Analysis Npentane	G.O. / Turbine
7256 / 7511	Read/Write	Live Analysis Nhexane	G.O. / Turbine
7257 / 7513	Read/Write	Live Analysis Nheptane	G.O. / Turbine
7258 / 7515	Read/Write	Live Analysis Noctane	G.O. / Turbine
7259 / 7517	Read/Write	Live Analysis NNonane	G.O. / Turbine
7260 / 7519	Read/Write	Live Analysis NDecane	G.O. / Turbine
7261 / 7521	Read/Write	Live Analysis Oxygen	G.O. / Turbine
7262 / 7523	Read/Write	Live Analysis Carbon Monoxide	G.O. / Turbine
7263 / 7525	Read/Write	Live Analysis Hydrogen	G.O. / Turbine
7264 / 7527	Read/Write	Live Analysis Argon	G.O. / Turbine
7265 / 7529	Read/Write	Custom group scale factor	G.O. / Turbine
7266 / 7531	Read/Write	Current flow rate in MCF/Day	G.O. / Turbine
7267-7333	Read/Write	User configurable registers	G.O. / Turbine
7334	Read Only	PG&E NULL Float Register	G.O.
7335	Read Only	Analog Valve Position	G.O.
7336	Read/Write	Valve Control Type Command	G.O.
7337	Read/Write	DP Low Time	G.O.
7338	Read Only	Analog Valve Controller Output	G.O.
7339	Read/Write	DP Override Gain (converted from int to float)	G.O.
7340	Read/Write	DP Shut-in Period	G.O.
7341	Read/Write	DP Shut-in Time Remaining	G.O.
7342	Read	Valve Status	G.O.
7343	Read/Write	AO #1 Associated Process Variable Low Value	G.O.
7344	Read/Write	AO #1 Associated Process Variable High Value	G.O.
7345	Read/Write	AO #1 Associated Process Variable Current Value	G.O.
7346	Read/Write	AO #2 Associated Process Variable Low Value	G.O.
7347	Read/Write	AO #2 Associated Process Variable High Value	G.O.
7348	Read/Write	AO #2 Associated Process Variable Current Value	G.O.
7349	Read/Write	AO #3 Associated Process Variable Low Value	G.O.
7350	Read/Write	AO #3 Associated Process Variable High Value	G.O.
7351	Read/Write	AO #3 Associated Process Variable Current Value	G.O.
7352	Read/Write	AO #4 Associated Process Variable Low Value	G.O.
7353	Read/Write	AO #4 Associated Process Variable High Value	G.O.
7354	Read/Write	AO #4 Associated Process Variable Current Value	G.O.
7355	Read	AI #1 Calibration Low Value	G.O.
7356	Read	AI #1 Calibration Mid Low Value	G.O.
7357	Read	AI #1 Calibration Mid Value	G.O.
7358	Read	AI #1 Calibration Mid High Value	G.O.
7359	Read	AI #1 Calibration High Value	G.O.
7360	Read	AI #2 Calibration Low Value	G.O.
7361	Read	AI #2 Calibration Mid Low Value	G.O.
7362	Read	AI #2 Calibration Mid Value	G.O.
7363	Read	AI #2 Calibration Mid High Value	G.O.
7364	Read	AI #2 Calibration High Value	G.O.
7365	Read	Current Flow Rate Station Total	G.O.
7366	Read	Current Day Volume Station Total	G.O.
7367	Read	Yesterday's Volume Station Total	G.O.
7368	Read/Write	Tube Switch Setpoint Low	G.O.
7369	Read/Write	Tube Switch Setpoint High	G.O.
7370	Read	Slave 1 DP	G.O.
7371	Read	Slave 2 DP	G.O.

Floating Point (cont.)

Register	Access	Description	Meter Type
7372	Read	Slave 3 DP	G.O.
7373	Read/Write	Tube Switch Hysteresis Low	G.O.
7374	Read/Write	Tube Switch Hysteresis High	G.O.
7375	Read	Current Flow MMCF/Day	G.O.
7376	Read	Current Energy MMBTU/Day	G.O.
7377–7386	Read/Write	User Floats	G.O./Turbine
7387	Read/Write	PI #1 Flow Window	Turbine
7388	Read/Write	PI #2 Flow Window	Turbine

X. TLP Register Group

The TLP registers are 3 byte data entities. These registers are read using function code 03 and set using function code 06 or 16. The base register number for this register group defaults to 15001 when the unit is cold started.

Register	Access	Description	Meter Type
15001	Read/Write	Primary Input Point	G.O. / Turbine
15002	Read/Write	Primary Output Point	G.O. / Turbine
15003	Read/Write	Primary Switch Variable	G.O. / Turbine
15004	Read/Write	Override Input Point	G.O. / Turbine
15005	Read/Write	Override Output point	G.O. / Turbine
15006	Read/Write	Override Switch Variable	G.O. / Turbine
15007	Read/Write	Low DP (stacked)	G.O. / Turbine
15008	Read/Write	DP Number (stacked)	G.O. / Turbine
15009	Read/Write	Static Press Number (stacked)	G.O. / Turbine
15010	Read/Write	Temp Number (stacked)	G.O. / Turbine
15011	Read/Write	NULL TLP Register	G.O. / Turbine

XI. Log Period Flow Record Register Group

Totalflow Log Period flow records are read using Modbus function code 03. The byte order of the record is reversed in the response packet (MSB of last field first, LSB of first field last.) The base register number for the Log Period Flow Record register group defaults to 11001 when the unit is cold started. It can be changed by setting register 106 to the desired starting register number of the group. Register 11001 accesses the most recent log period record, register 11970 accesses the least recent log period record.

Gas Orifice Log Period Flow Record Format

Field	Size	Type	Description
Date/time	4	ULONG	Log Date/Time (# seconds since 00:00:00 1/1/70)
Sequence #	2	UINT	Log Period record sequence number
Average DP	4	FLOAT	Average differential pressure during flow
Average SP	4	FLOAT	Average static pressure during flow
Average TF	4	FLOAT	Average temperature
Extension	4	FLOAT	Accumulated Extension / 3600
Volume	4	FLOAT	Total volume for the day (MCF)
Energy	4	FLOAT	Total energy for the day
Flowtime	4	ULONG	Total flow seconds for the day
Period time	4	ULONG	Total seconds actually used in this log period
Alarms	3	24BITS	Period alarm summary (See alarm bit mapping)
Verification Code	1	UCHAR	8 Bit Proprietary Checksum

Turbine Log Period Flow Record Format

Field	Size	Type	Description
Date/time	4	ULONG	Log Date/Time (# seconds since 00:00:00 1/1/70)
Sequence #	2	UINT	Log Period record sequence number
Pulse Count	4	FLOAT	Total pulse count for the period
Average SP	4	FLOAT	Average static pressure during flow
Average TF	4	FLOAT	Average temperature
Uncorrected Volume	4	FLOAT	Total uncorrected volume for the day (MACF)
Volume	4	FLOAT	Total volume for the day (MCF)
Energy	4	FLOAT	Total energy for the day
Flowtime	4	ULONG	Total flow seconds for the day
Period time	4	ULONG	Total seconds actually used in this log period
Alarms	3	24BITS	Period alarm summary (See alarm bit mapping)
Verification Code	1	UCHAR	8 Bit Proprietary Checksum

XII. Daily Flow Record Register Group

Totalflow Daily flow records are read using Modbus function code 03. The byte order of the record is reversed in the response packet (MSB of last field first, LSB of first field last.) The base register number for the Daily Flow Record register group defaults to 10001 when the unit is cold started. It can be changed by setting register 105 to the desired starting register number of the group. Register 10001 accesses the most recent daily record, register 10050 accesses the least recent daily record.

Gas Orifice Daily Flow Record Format

Field	Size	Type	Description
Date/time	4	ULONG	Day Date/Time (# seconds since 00:00:00 1/1/70)
Sequence #	2	UINT	Daily record sequence number
Event Sequence #	2	UINT	Event sequence counter at start of day
Starting Log Seq#	2	UINT	1st Log Period record assigned to this day
Ending Log Seq#	2	UINT	Last Log Period record assigned to this day
Contract Hour	1	UCHAR	Start of gas day per contract
Extension	4	FLOAT	Accumulated Extension / 3600
Volume	4	FLOAT	Total volume for the day (MCF)
Energy	4	FLOAT	Total energy for the day
Flowtime	4	ULONG	Total flow seconds for the day
Backflow	4	ULONG	Total backflow seconds for the day
Period time	4	ULONG	Total seconds actually used in this log period
Alarms	3	24BITS	Daily alarm summary (See alarm bit mapping)
Average SP	4	FLOAT	Average static pressure during flow
Min SP	4	FLOAT	Minimum SP value observed during this period
Max SP	4	FLOAT	Maximum SP value observed during this period
% time SP high	4	FLOAT	SP percent of day above hi limit
% time SP low	4	FLOAT	SP percent of day below lo limit
Average DP	4	FLOAT	Average differential pressure during flow
Min DP	4	FLOAT	Minimum DP value observed during this period
Max DP	4	FLOAT	Maximum DP value observed during this period
% time DP high	4	FLOAT	DP percent of day above hi limit
% time DP low	4	FLOAT	DP percent of day below lo limit
Average TF	4	FLOAT	Average temperature
Min TF	4	FLOAT	Minimum Temp value observed during this period
Max TF	4	FLOAT	MaximumTemp value observed during this period
% time TF high	4	FLOAT	Tf percent of day above hi limit
% time TF low	4	FLOAT	Tf percent of day below low limit
Verification Code	1	UCHAR	8 Bit Proprietary Checksum

Turbine Daily Flow Record Format

Field	Size	Type	Description
Date/time	4	ULONG	Day Date/Time (# seconds since 00:00:00 1/1/70)
Sequence #	2	UINT	Daily record sequence number
Event Sequence #	2	UINT	Event sequence counter at start of day
Starting Log Seq#	2	UINT	1st Log Period record assigned to this day
Ending Log Seq#	2	UINT	Last Log Period record assigned to this day
Contract Hour	1	UCHAR	Start of gas day per contract
Uncorrected Volume	4	FLOAT	Total uncorrected volume for the day (MACF)
Volume	4	FLOAT	Total volume for the day (MCF)
Energy	4	FLOAT	Total energy for the day
Flowtime	4	ULONG	Total flow seconds for the day
Backflow	4	ULONG	Total backflow seconds for the day
Period time	4	ULONG	Total seconds actually used in this log period
Alarms	3	24BITS	Daily alarm summary (See alarm bit mapping)
Average SP	4	FLOAT	Average static pressure during flow
Min SP	4	FLOAT	Minimum SP value observed during this period
Max SP	4	FLOAT	Maximum SP value observed during this period
% time SP high	4	FLOAT	SP percent of day above hi limit
% time SP low	4	FLOAT	SP percent of day below lo limit
Pulse Count	4	FLOAT	Total pulse count for the day
Min Pulse Count	4	FLOAT	Minimum pulse count observed during this period
Max Pulse Count	4	FLOAT	Maximum pulse count observed during this period
% time ACF high	4	FLOAT	ACF percent of day above hi limit
% time ACF low	4	FLOAT	ACF percent of day below lo limit
Average TF	4	FLOAT	Average temperature
Min TF	4	FLOAT	Minimum Temp value observed during this period
Max TF	4	FLOAT	MaximumTemp value observed during this period
% time TF high	4	FLOAT	Tf percent of day above hi limit
% time TF low	4	FLOAT	Tf percent of day below low limit
Verification Code	1	UCHAR	8 Bit Proprietary Checksum

XIII. Alarm bit mapping for Totalflow Daily and Log Period records

Bit	Description
0	AGA Calculation error
1	Methane gravity method f(pv) used
2	Alternate analysis used
3	Low lithium battery
4	Low charger
5	DP measurement error
6	SP measurement error
7	Temperature measurement error
8	Auxiliary contact #1 tripped
9	Remote sense #1 detected
10	Back flow detected
11	Zero flow detected
12	DP below low limit
13	DP over high limit
14	SP below low limit
15	SP over high limit
16	Auxiliary contact #2 tripped
17	Remote sense #2 detected
18	Tf below low limit
19	Tf above high limit

XIV. Event Log Record Register Group

Totalflow Event records are read using Modbus function code 03. The base register number for this register group defaults to 12001 when the unit is cold started. It can be changed by setting register 107 to the desired starting register number of the group. Register 12001 accesses the most recent event log record, register 12200 accesses the least recent event log record. The byte order of the record is reversed in the response packet (MSB of last field first, LSB of first field last.)

Field	Size	Type	Description
Date/time	4	ULONG	# of seconds since 00:00:00 1/1/70
Event flags	1	BITS	Event flags (such as day skip)
Event Sequence #	2	UINT	Sequence # of event
Event Code	2	UINT	Describes event type (Table 5.13)
Old Value	4	Depends on Code	Value changed from...
New Value	4	Depends on Code	Value changed to...
Verification Code	1	UCHAR	8 Bit Proprietary Checksum

Totalflow Event data types

Type	Old Value Format	New Value Format
1	Unsigned Integer	Unsigned Integer
2	Unsigned Char	Unsigned Char
3	BOOL	BOOL
4	IEEE Floating Point	N/A (Rollover)
5	IEEE Floating Point	IEEE Floating Point
8	Unsigned Long Integer	Unsigned Long Integer
9	2 Character String	2 Character String

Totalflow Event Codes

Event Code	Data Type	Description
1	8	New date and time
5	1	Contract day starting hour
8	8	AIU Stream ID
9	3	Use fixed analysis on error?
10	2	Reset volume
11	2	Wakeup from sleep
12	2	Go to sleep
13	2	Watchdog timeout
14	2	Accumulated volume rollover
15	2	Security code changed
16	3	Attached to AIU stream?
19	3	Is SP present?
20	3	RTD installed
21	3	Use fixed temperature
24	3	SS/Monel orifice plate
25	3	Use Fb
26	3	Use Fr
27	3	Use Y
28	3	Use Ftb
29	3	Use Fpb

Event Codes (cont.)

30	3	Use Ftf
31	3	Use Fg
32	3	Use Fpv
33	3	Use Fa
34	3	Use contact on charger low
35	3	Contact on dp lo
36	3	Contact on dp hi
37	3	Contact on SP lo
38	3	Contact on SP hi
39	3	Contact on remote sense
40	3	Auto re-open
41	3	Contact on vol set point
42	3	Use Fw
43	3	Use Faux
44	3	Use Fpm (TURBINE_REV)
45	3	Use Ftm (TURBINE_REV)
46	3	Use s (TURBINE_REV)
47	3	Use Faux (TURBINE_REV)
49	5	fixed SP value (TURBINE_REV)
50	4	well log code (Site Code)
51	4	Accumulated volume reset
52	3	RTD installed (TURBINE)
53	3	Use rtd (TURBINE)
54	3	Auto start TEG (TURBINE)
55	3	Check security code(TURBINE)
56	3	Use fixed SP (TURBINE)
57	4	Accum ACF before reset (TRB)
58	4	Initial volume reset value(TRB)
59	2	Accum ACF rollover date (TRB)
60	5	Fb
61	5	Orifice diameter
62	5	Pipe diameter
63	5	Specific gravity
64	5	DP low limit
65	5	DP hi limit
66	5	SP low limit
67	5	SP hi limit
68	5	CO2 mole percent
69	5	N2 mole percent
70	5	SP low calibration
71	5	SP mid calibration
72	5	SP hi calibration
73	5	DP low calibration
74	5	DP mid calibration
75	5	DP hi calibration
76	5	DP zero cutoff
77	5	Temperature base
78	5	Pressure base
79	5	Fixed temperature

Event Codes (cont.)

80	5	Temperature bias
81	5	Viscosity
82	5	Ratio of specific heats
83	5	Ft – gravity adjusted temp
84	5	Fp – gravity adjusted press
85	5	BTU/SCF
86	5	SP pressure marker
87	5	DP pressure marker
88	3	Contact on charger low (TRB)
89	3	Contact on acf low (TRB)
90	3	Contact on acf hi (TRB)
91	3	Contact on SP low (TRB)
92	3	Contact on SP hi (TRB)
93	3	Contact on remote sense (TRB)
94	3	Contact auto re-open (TRB)
95	3	Contact on vol set point (TRB)
96	5	ACF Low Limit (TURBINE)
97	5	ACF Hi Limit (TURBINE)
98	5	Flow period (TURBINE)
99	5	Faux (TURBINE)
100	5	Faux
101	5	K (TURBINE)
102	5	Initial analysis OK?
103	5	VCF K0
104	5	VCF K1
105	5	VCF K2
106	1	Liquid type
107	1	Calculation units type
108	1	Z method
111	1	AGA calculation type
112	5	Fixed cd
115	5	Zba
116	9	Software revision change
117	1	Volume calculation period
118	8	Volume log period
119	5	H2S content
120	5	H20 content
121	5	Helium content
122	5	Methane content
123	5	Ethane content
124	5	Propane content
125	5	N-Butane content
126	5	I-Butane content
127	5	N-Bentane content
128	5	I-Pentane content
129	5	N-Hexane content

Event Codes (cont.)

130	5	N-Heptane content
131	5	N-Octane content
132	5	N-Nonane content
133	5	N-Decane content
134	5	Oxygen content
135	5	Carbon Monoxide content
136	5	Orifice coefficient of expansion
137	5	Pipe coefficient of expansion
138	5	barometric pressure
142	1	Characteristic type
143	3	Calculated or Fixed Cd in vol calc
144	5	Fixed Argon mole percent
145	5	Fixed hydrogen mole percent
146	4	Accumulated volume rollover
147	4	Event log full (CANADIAN EVENT)
148	4	Event log collected (CANADIAN)
149	1	Password mode, operator change
150	3	Password mode, password enable
151	2	Password mode, password table
152	2	A/D converter could not be read
153	5	SP mid low calibration event
154	5	SP mid hi calibration event
155	5	DP mid low calibration event
156	5	DP mid hi calibration event
157	3	Use Faux
158	3	static pressure tap up/downstream
159	3	Use Y expansion factor
160	3	Use Fpv factor
161	3	Use Fw water vapor factor
162	5	Reset Log Period
164	3	Use Linear/Sqrt Averaging
165	3	Hold last read analog values (SP, DP, TF)
166	1	Maximum number of events log records
167	1	Maximum number of day period records
168	1	Maximum number of log period records
169	1	Size of local port communications buffer
170	1	Size of remote port communications buffer
171	8	Partition memory free space
172	3	Use fixed water content in wet gas calcs
173	5	Water content (LBS/MMSCF)
174	5	Water content bias

XV. Radio Power Duty Cycling and Group Operation.

Duty cycling the power to the radio can significantly decrease the solar panel and battery requirements of a remote installation. Totalflow Modbus uses group addressing to control radio duty cycling. Using Modbus group addresses also removes the standard Modbus limit of 247 slave addresses per communications channel.

Totalflow Modbus group addressing and radio duty cycling work as follows:

Writing a group number into the Modbus group address register (3070) invokes Modbus group addressing. The FCU will listen for its standard Modbus slave address (0-247) only when the Modbus group address register (3070) matches the current group select register (3071) set by a previous broadcast.

The duty cycle is specified by setting the link establishment register (3020) to the desired cycle time (seconds). The FCU will power the radio once each duty cycle and listen for broadcasts. A duty cycle time of zero (0) means that the radio is always powered (used for group addressing without duty cycling).

When the remote unit is duty cycling the radio, the host must broadcast function code 6 (single register write command) to the current group select register (3071) continuously for the duty cycle interval. This forces remote units with matching Modbus group address registers (3070) to keep it's radio powered up and listen for subsequent commands (addressed to the standard slave address) until the group address register (3070) no longer matches the current group select register (3071).

The group returns to duty cycling when the host broadcasts a different group select. The current group select register is also reset (to 0) upon expiration of the maximum listen time specified in the listen timeout register (3072).

For example, the following ASCII mode broadcast command would set the current group select register to 1. As mentioned above, this command must be repeated for the configured duty cycle.

Broadcast :

BOF	Address	Function	Register	Data	LRC	EOF	Ready
:	00	06	0B FF	00 01	??	CR	LF

The remote device does not respond to the broadcast. It powers the radio and listens for Modbus commands directed to it's standard Modbus slave address. When the host is finished polling this group, it switches to the next group by broadcasting a new group select address. If the host does not intend to switch to a new group, it should disable the current group by broadcasting a group select of zero (0).

XVI. PG&E Poll Group Protocol

The Poll Group Protocol uses an expanded set of TotalFlow's custom register group whose base is at 8000. Each Poll Group consists of 62 registers, each of which is four (4) bytes in length. The first four registers of each Poll Group are in packed binary format, while all other registers are floating point values. The first register of each group accesses Modbus register 5027 and sets each bit according to the alarm status of the first 29 registers requested. The second register of each group accesses Modbus register 5028 and sets the bits with alarm values for the remaining 28 registers. An alarm status can only be set if the corresponding register was read on the current request. Any registers which are not read will have the alarm bit defaulted to zero(0) representing no alarm. The following table shows the definition of these two registers.

Register	*Bit Description*
5027	Bit 0 = Not Used (always 0)
	Bit 1 = Not Used (always 0)
	Bit 2 = Alarm Status of First Floating Point Value (register 4)
	♦
	♦
	♦
	Bit 31 = Alarm Status of Register 33
5028	Bit 0 = Alarm Status of Register 34
	♦
	♦
	♦
	Bit 27 = Alarm Status of Last Floating point Value (register 58)
	Bits 28 – 31 = Not Used (always 0)

Example: If the first floating point register requested was associated with the current flow rate and its' value was greater than that set as the high limit the following would be seen:

00000000 00000000 00000000 00000100

The third packed binary register contains information on the status of the discrete inputs. This register (5029) is updated when any Poll Group request is made or when any Block operation is performed by reading the physical state of the pin associated with each discrete input. The discrete input register is Read Only. The fourth packed binary register is mapped through register 5030 and allows the user to view the status of the discrete outputs on a 'Read' operation, or to set specific discrete outputs on a 'Write' operation. Again, the status of the discrete outputs is obtained by physically examining the state of the pin associated with each discrete output. When a 'Write' is performed through this register the discrete outputs remain 'On' for a default of 15 seconds. The following table and example will illustrate the use of the discrete inputs and outputs.

Register	*Bit Description*
5029	Bit 32 = Status of DI 1
	Bit 31 = Status of DI 2
	Bit 30 = Status of VCI DI 1
	Bit 29 = Status of VCI DI 2
	Bit 28 = Status of VCI DI 3
	Bit 27 = Status of VCI DI 4
	Bits 26 – 0 Not used (always 0)
5030	Bit 32 = Status/Set DO 1
	Bit 31 = Status/Set DO 2
	Bit 30 = Status/Set VCI DO 1
	Bit 29 = Status/Set VCI DO 2
	Bit 28 = Status/Set VCI DO 3
	Bit 27 = Status/Set VCI DO 4
	Bits 26 – 0 Not Used (always 0)

Example: Following a 'Read', the following is displayed on the screen:

8002	Discrete Input Status	10001100 00000000 00000000 00000000
8003	Discrete Output Status	10010000 00000000 00000000 00000000

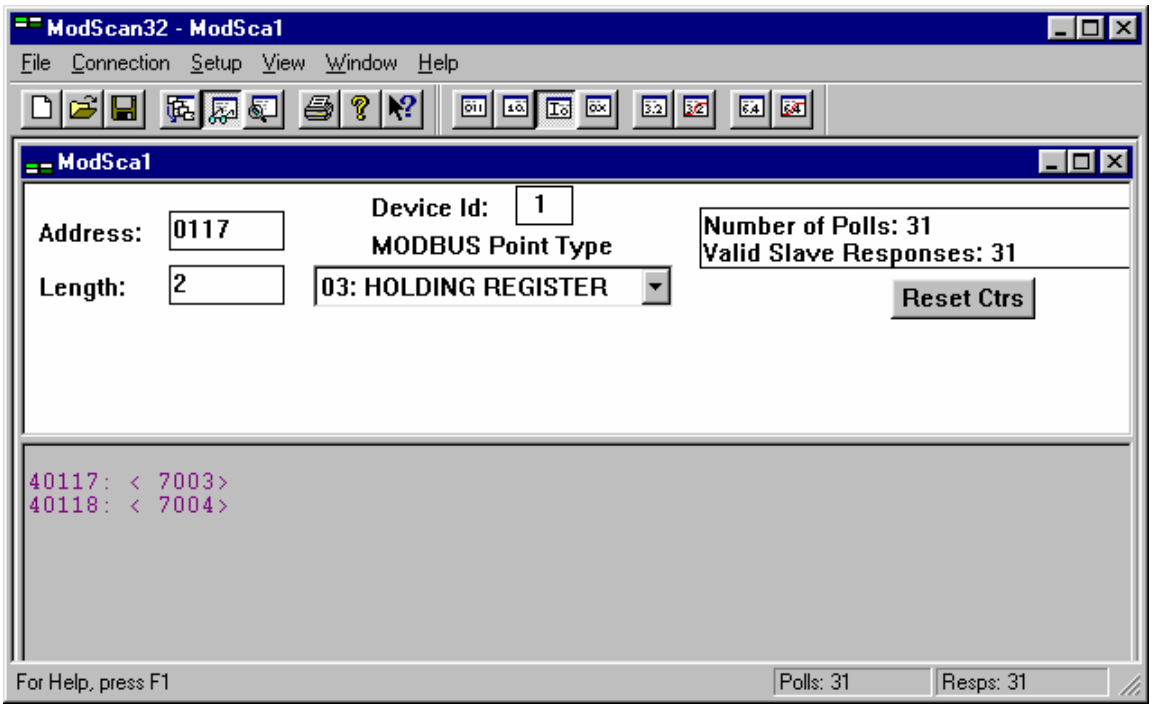
Correlating what is shown on the screen with the above table this says that DI 1, and VCI DI's 3 and 4 are active and that DO 1 and VCI DO 2 are currently 'On'.

Customization:

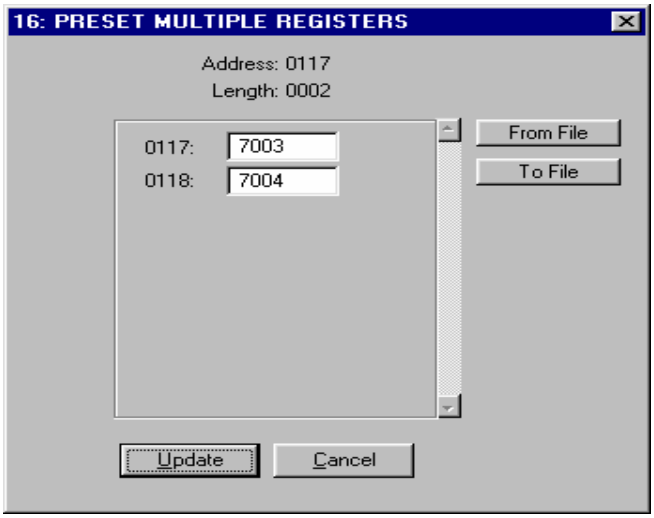
The Poll Groups are an extended set of TotalFlow custom Modbus registers. They are mapped into the 100 series registers where register 110 sets the base for the custom registers. In this case, the base is set to 8000 and there are 248 user configurable registers which begin with register 111. Each user configurable register points to a TotalFlow standard register containing the data associated with that variable. The maps for TotalFlow standard registers are contained in above sections such as XIIII. Floating Point Register Group. The factory default mapping for the Poll Groups is located in the next section XVI. Poll Group Tables. It is possible for the user to reconfigure these registers based on their particular needs, and the methods to accomplish this will be discussed in this section.

ModScan 32 is a commercially available interface which offers many benefits to the user. One of these benefits is the ability to set multiple registers through a graphical interface and see the results of the action at the same time. This package is available at www.win-tech.com for under $100.

To illustrate how the user can modify the layout of the Poll Groups, consider that it is desired to change Poll Group 1 so that user configurable registers 7 and 8 switch positions in the table. Referring to the table for Poll Group 1 in the next section this equates to swapping the positions of Current static pressure (8006) and Current Differential pressure (8007). These equate to custom registers 117 and 118, respectively. A read of these registers with ModScan will show that they point to standard registers 7003 and 7004 as the following screen shows.



To perform the swap of these registers, select Setup| Extended|Preset Regs and the following screen will appear.



At this point, enter 7004 for the value of 117 and 7003 as the value for 118, Update, and the Poll Group table in the flow computer has been modified. This process can be repeated for any other modifications required to the Poll Groups.

XVII. Poll Group Tables

Poll groups will act like custom registers and so will be mapped into the 8000 area. There are 4 distinct poll groups and will be arranged as follows.

8000-8061	Poll Group 1
8062-8123	Poll Group 2
8124-8185	Poll Group 3
8186-8247	Poll Group 4

Poll Group 1

ModScan Address	Poll Register	Std Register	Read/Write	Description	Units	Meter Type
115	8004	7004/7334	Read Only	Current Differential Pressure / NULL	Inches H2O	G.O./P.I.
116	8005	7003	Read Only	Current static pressure	psia	
117	8006	7005	Read Only	Current temperature	degrees F	
118	8007	7375	Read Only	Current flow rate	MMCF/Day	
119	8008	7009	Read Only	Current contract day volume	MCF	
120	8009	7154	Read Only	Yesterday's contract day accumulated volume	MCF	
121	8010	7365/7334	Read Only	Current flow rate station total / NULL	MMCF/Day	G.O./P.I.
122	8011	7366/7334	Read Only	Current day volume station total /NULL	MCF	G.O./P.I.
123	8012	7367/7334	Read Only	Yesterday's volume station total /NULL	MCF	G.O./P.I.
124	8013	7001	Read Only	Current battery volts	volts	
125	8014	7002	Read Only	Current charger volts	volts	
126	8015	7155	Read Only	External AI 1 value		
127	8016	7156	Read Only	External AI 2 value		
128	8017	7061/7334	Read/Write	orifice size at reference temperature / NULL	Inches	G.O./P.I.
129	8018	7063/7334	Read/Write	pipe size at reference temperature / NULL	Inches	G.O./P.I.
130	8019	7376	Read Only	Current energy rate	MMBTU/Day	
131	8020	7153	Read Only	Yesterday's contract day accumulated energy	MMBTU	
132	8021	7008	Read Only	Current accumulated volume (Totals to 99999 until rolls over)	MCF	
133	8022	7026	Read/Write	Energy content	BTU/SCF	
134	8023	7027	Read/Write	real specific gravity		
135	8024	7028	Read/Write	CO2	mole percent	
136	8025	7029	Read/Write	N2	mole percent	
137	8026	7030	Read/Write	Methane	mole percent	
138	8027	7368/7334	Read/Write	Tube Switch Setpoint Low / NULL	Inches H2O	G.O./P.I.
139	8028	7369/7334	Read/Write	Tube Switch Setpoint High / NULL	Inches H2O	G.O./P.I.
140	8029	7373/7334	Read/Write	Tube Switch Hysteresis Low / NULL	Seconds	G.O./P.I.
141	8030	7374/7334	Read/Write	Tube Switch Hysteresis High / NULL	Seconds	G.O./P.I.
142	8031	7370/7334	Read Only	Slave 1 DP / NULL	Inches H2O	G.O./P.I.
143	8032	7371/7334	Read Only	Slave 2 DP / NULL	inches H2O	G.O./P.I.
144	8033	7372/7334	Read Only	Slave 3 DP / NULL	inches H2O	G.O./P.I.
145	8034	7224	Read/Write	Valve Control AP Bias		
146	8035	7225/7225	Read/Write	Valve Control DP High / Valve Control Uncorr Vol High		G.O./P.I.
147	8036	7226/7226	Read/Write	Valve Control DP Low / Valve Control Uncorr Vol Low		G.O./P.I.

Poll Group 1 (cont.)

148	8037	7227/7227	Read/Write	Valve Control DP Setpoint / Valve Control Uncorr Vol Setpoint		G.O./P.I.
149	8038	7228/7228	Read/Write	Valve Control DP Dead Band / Valve Control Uncorr Vol Dead Band		G.O./P.I.
150	8039	7229	Read/Write	Valve Control Pipe Length		
151	8040	7230	Read/Write	Valve Control AP High		
152	8041	7231	Read/Write	Valve Control AP Low		
153	8042	7232	Read/Write	Valve Control AP Setpoint		
154	8043	7233	Read/Write	Valve Control AP Dead Band		
155	8044	7234	Read/Write	Valve Control Pipe ID		
156	8045	7235	Read/Write	Valve Control FR High		
157	8046	7236	Read/Write	Valve Control FR Low		
158	8047	7237	Read/Write	Valve Control FR Setpoint		
159	8048	7238	Read/Write	Valve Control FR Dead Band		
160	8049	7239	Read/Write	Valve Control Battery Voltage		
161	8050	7240	Read/Write	Valve Control AP Override		
162	8051	7241	Read/Write	Valve Control AP Restart		
163	8052	7010/7334	Read Only	last log period differential / NULL	inches H2O	G.O./P.I.
164	8053	7011	Read Only	last log period static	psia	
165	8054	7012	Read Only	last log period temperature	Degrees F	
166	8055	7013/7334	Read Only	last log period extension / NULL		G.O./P.I.
167	8056	7014	Read Only	last log period volume	MCF	
168	8057	7015	Read Only	last log period energy	MBTU	
169	8058	7016	Read Only	last log period flow time	seconds	
170	8059	7017	Read Only	last log period time	seconds	
171	8060	7018/7334	Read Only	last day period differential / NULL	inches H2O	G.O./P.I.
172	8061	7019	Read Only	last day period static	psia	

Poll Group 2

ModScan Address	Poll Register	Std Register	Read/Write	Description	Units	Meter Type
177	8066	7020	Read Only	last day period temperature	degrees F	
178	8067	7021/7334	Read Only	last day period extension / NULL		G.O./P.I.
179	8068	7022	Read Only	last day period volume	MCF	
180	8069	7023	Read Only	last day period energy	MBTU	
181	8070	7024	Read Only	last log period flow time	seconds	
182	8071	7025	Read Only	Last log period time	seconds	
183	8072	7128	Read Only	SP low cal point	psia	
184	8073	7129	Read Only	SP mid cal point	psia	
185	8074	7130	Read Only	SP high cal point	psia	
186	8075	7131/7334	Read Only	DP low cal point / NULL	inches H2O	G.O./P.I.
187	8076	7132/7334	Read Only	DP mid cal point / NULL	inches H2O	G.O./P.I.
188	8077	7133/7334	Read Only	DP high cal point / NULL	inches H2O	G.O./P.I.
189	8078	7135	Read Only	current unfiltered SP	psia	
190	8079	7136/7334	Read Only	current unfiltered DP / NULL	inches H2O	G.O./P.I.
191	8080	7134	Read Only	current unfiltered temp	degrees F	
192	8081	7050	Read/Write	temperature bias	degrees F	
193	8082	7049	Read/Write	Fixed temp	Degrees F	
194	8083	7055	Read/Write	Fb (AGA 3 1985)		
195	8084	7051	Read/Write	base temperature	degrees F	
196	8085	7052	Read/Write	base pressure	psia	
197	8086	7065	Read/Write	barometric pressure	psia	

198	8087	7057	Read/Write	Faux		

Poll Group 2 (cont.)

199	8088	7053/7334	Read/Write	ratio of specific heats / NULL		G.O./P.I.
200	8089	7054/7334	Read/Write	Viscosity / NULL	centipoise	G.O./P.I.
201	8090	7058	Read/Write	ft for Fpv		
202	8091	7059	Read/Write	fp for Fpv		
203	8092	7066	Read/Write	Water content	lbs/MMCF	
204	8093	7067	Read/Write	water content bias	lbs/MMCF	
205	8094	7056/7334	Read/Write	Fixed Cd / NULL		G.O./P.I.
206	8095	7060/7334	Read/Write	Z base of air / NULL		G.O./P.I.
207	8096	7062/7334	Read/Write	Orifice coefficient of expansion/NULL		G.O./P.I.
208	8097	7064/7334	Read/Write	Pipe coefficient of expansion / NULL		G.O./P.I.
209	8098	7355	Read/Write	AI #1 calibration low value		
210	8099	7356	Read/Write	AI #1 calibration mid low value		
211	8100	7357	Read/Write	AI #1 calibration mid value		
212	8101	7358	Read/Write	AI #1 calibration mid high value		
213	8102	7359	Read/Write	AI #1 calibration high value		
214	8103	7360	Read/Write	AI #2 calibration low value		
215	8104	7361	Read/Write	AI #2 calibration mid low value		
216	8105	7362	Read/Write	AI #2 calibration mid value		
217	8106	7363	Read/Write	AI #2 calibration mid high value		
218	8107	7364	Read/Write	AI #2 calibration high value		
219	8108	7068/7334	Read Only	Last volume calculation DP value / NULL	Inches H2O	G.O./P.I.
220	8109	7069	Read Only	Last volume calculation SP	Psia	
221	8110	7070	Read Only	Last volume calculation Tf	Temperature	
222	8111	7071	Read Only	Last volume calculation volume	MCF	
223	8112	7072/7334	Read Only	Last volume calculation extension / NULL		G.O./P.I.
224	8113	7073	Read Only	Last volume calculation Cprime or integral multiplier		
225	8114	7074/7334	Read Only	Last volume calculation Y expansion factor / NULL		G.O./P.I.
226	8115	7075	Read Only	Last volume calculation Fpv		
227	8116	7076	Read Only	Last volume calculation Fw – water vapor factor		
228	8117	7077	Read Only	Last volume calculation Faux – auxiliary factor		
229	8118	7078	Read Only	Last volume calculation flow rate	SCF/hour	
230	8119	7079/7334	Read Only	Last volume calculation Fb, AGA-3 1985 / NULL		G.O./P.I.
231	8120	7080/7334	Read Only	Last volume calculation Fr – Reynolds number factor, AGA-3, 1985 / NULL		G.O./P.I.
232	8121	7081/7334	Read Only	Last volume calculation Fpb, pressure base factor, AGA-3, 1985 / NULL		G.O./P.I.
233	8122	7082/7334	Read Only	Last volume calculation Ftb, temperature base factor, AGA-3, 1985 / NULL		G.O./P.I.
234	8123	7083/7334	Read Only	Last volume calculation Ftf, flow temperature factor, AGA-3, 1985 / NULL		G.O./P.I.

Poll Group 3

ModScan Address	Poll Register	Std Register	Read/Write	Description	Units	Meter Type
239	8128	7084/7334	Read Only	Last volume calculation Fg, gravity factor, AGA-3, 1985 / NULL		G.O./P.I.
240	8129	7085/7334	Read Only	Last volume calculation Fa, orifice thermal expansion factor, AGA-3, 1985 / NULL		G.O./P.I.
241	8130	7086/7334	Read Only	Last volume calculation Fip, pressure dependent part of AGA-3, 1992 / NULL		G.O./P.I.
242	8131	7087/7334	Read Only	Last volume calculation Ev, velocity of approach, AGA-3, 1992 / NULL		G.O./P.I.
243	8132	7088/7334	Read Only	Last volume calculation Orifice diameter corrected to flow temperature, AGA-3, 1992 / NULL	Inches	G.O./P.I.
244	8133	7089/7334	Read Only	Last volume calculation Pipe diameter corrected to flow temperature, AGA-3, 1992 / NULL	Inches	G.O./P.I.
245	8134	7090/7334	Read Only	Last volume calculation density at base conditions, AGA-3, 1992 / NULL	Lbs mass/cf	G.O./P.I.
246	8135	7091/7334	Read Only	Last volume calculation mass flow rate / NULL	Lbs mass/hour	G.O./P.I.
247	8136	7092/7334	Read Only	Last volume calculation Coefficient of discharge (Cd), AGA-3, 1992 / NULL		G.O./P.I.
248	8137	7093	Read Only	Last volume calculation heating value	BTU/SCF	
249	8138	7094	Read Only	Last volume calculation real specific gravity		
250	8139	7095	Read Only	Last volume calculation CO2 content	Mole percent	
251	8140	7096	Read Only	Last volume calculation nitrogen content	Mole percent	
252	8141	7097	Read Only	Last volume calculation methane content	Mole percent	
253	8142	7098	Read Only	Last volume calculation ethane content	Mole percent	
254	8143	7099	Read Only	Last volume calculation propane content	Mole percent	
255	8144	7100	Read Only	Last volume calculation iso-butane content	Mole percent	
256	8145	7101	Read Only	Last volume calculation normal butane content	Mole percent	
257	8146	7102	Read Only	Last volume calculation iso-pentane content	Mole percent	
258	8147	7103	Read Only	Last volume calculation normal pentane content	Mole percent	
259	8148	7104	Read Only	Last volume calculation normal hexane content	Mole percent	
260	8149	7105	Read Only	Last volume calculation normal heptane content	Mole percent	
261	8150	7106	Read Only	Last volume calculation normal octane content	Mole percent	
262	8151	7107	Read Only	Last volume calculation normal nonane content	Mole percent	
263	8152	7108	Read Only	Last volume calculation hydrogen sulfide content	Mole percent	
264	8153	7109	Read Only	Last volume calculation hydrogen content	Mole percent	

Poll Group 3 (cont.)

265	8154	7110	Read Only	Last volume calculation helium content	Mole percent	
266	8155	7111	Read Only	Last volume calculation oxygen content	Mole percent	
267	8156	7112	Read Only	Last volume calculation carbon monoxide content	Mole percent	
268	8157	7113	Read Only	Last volume calculation argon content	Mole percent	
269	8158	7114	Read Only	Last volume calculation normal decane	Mole percent	
270	8159	7115	Read Only	Last volume calculation water content	Mole percent	
271	8160	7116/7334	Read/Write	DP zero cutoff / NULL	Inches H2O	G.O./P.I.
272	8161	7117/7334	Read/Write	DP low limit / NULL	Inches H2O	G.O./P.I.
273	8162	7118/7334	Read/Write	DP high limit / NULL	Inches H2O	G.O./P.I.
274	8163	7119	Read/Write	SP low limit	Psia	
275	8164	7120	Read/Write	SP high limit	Psia	
276	8165	7121	Read/Write	Temperature low limit	Degrees F	
277	8166	7122	Read/Write	Temperature high limit	Degrees F	
278	8167	7123	Read/Write	Flow rate low limit	Scf/hour	
279	8168	7124	Read/Write	Flow rate high limit	Scf/hour	
280	8169	7125	Read/Write	Contact output volume setpoint	Mcf	
281	8170	7151	Read Only	Accumulated Energy	MMBTU	
282	8171	7152	Read Only	Current contract day accumulated energy	MMBTU	
283	8172	7161	Read Only	Current contract day PI 1 value	Accumulated PI 1 counts * k for current contract day	
284	8173	7162	Read Only	Current contract day PI 2 value	Accumulated PI 2 counts * k for current contract day	
285	8174	7163	Read Only	Previous contract day PI 1 value	Previous contract day PI 1 counts * k	
286	8175	7164	Read Only	Previous contract day PI 2 value	Previous contract day PI 2 counts * k	
287	8176	7165	Read Only	Current PI 1 value	PI 1 counts * k	
288	8177	7166	Read Only	Current PI 2 value	PI 2 counts * k	
289	8178	7159	Read/Write	PI 1 k value		
290	8179	7160	Read/Write	PI 2 k value		
291	8180	7140/7334	Read/Write	DP test input value / NULL	Inches H2O	G.O./P.I.
292	8181	7139	Read/Write	SP test input value	Psia	
293	8182	7138	Read/Write	Rtd test input value	Degrees F	
294	8183	7242	Read/Write	Live real specific gravity input		
295	8184	7243	Read/Write	Live heating value input	BTU/scf	
296	8185	7244	Read/Write	Live CO2 content	Mole percent	

Poll Group 4

ModScan Address	Poll Register	Std Register	Read/Write	Description	Units	Meter Type
301	8190	7245	Read/Write	Live N2 content	Mole percent	
302	8191	7246	Read/Write	Live methane content	Mole percent	
303	8192	7250	Read/Write	Live ethane content	Mole percent	
304	8193	7251	Read/Write	Live propane content	Mole percent	
305	8194	7252	Read/Write	Live iso-butane content	Mole percent	
306	8195	7253	Read/Write	Live normal butane content	Mole percent	
307	8196	7254	Read/Write	Live iso-pentane content	Mole percent	
308	8197	7255	Read/Write	Live normal pentane content	Mole percent	
309	8198	7256	Read/Write	Live normal hexane content	Mole percent	
310	8199	7257	Read/Write	Live normal heptane content	Mole percent	
311	8200	7258	Read/Write	Live normal octane content	Mole percent	
312	8201	7259	Read/Write	Live normal nonane content	Mole percent	
313	8202	7260	Read/Write	Live normal decane content	Mole percent	
314	8203	7261	Read/Write	Live oxygen content	Mole percent	
315	8204	7262	Read/Write	Live carbon monoxide content	Mole percent	
316	8205	7263	Read/Write	Live hydrogen content	Mole percent	
317	8206	7264	Read/Write	Live argon content	Mole percent	
318	8207	7247	Read/Write	Live hydrogen sulfide content	Mole percent	
319	8208	7248	Read/Write	Live H2O content	Mole percent	
320	8209	7249	Read/Write	Live helium content	Mole percent	
321	8210	7174/7387	Read/Write	User float 1 / PI #1 Flow Window	None/Sec	G.O./P.I.
322	8211	7175/7142	Read/Write	User float 2 / Current Uncorrected Flow Rate		G.O./P.I.
323	8212	7176/7143	Read/Write	User float 3 / Uncorrected Accumulated Volume		G.O./P.I.
324	8213	7177/7144	Read/Write	User float 4 / Yesterday's Uncorrected Volume		G.O./P.I.
325	8214	7178/7145	Read/Write	User float 5 / Last Calc Period Uncorrected Volume		G.O./P.I.
326	8215	7179/7146	Read/Write	User float 6 / Last Calc Period S (Fpv^2)		G.O./P.I.
327	8216	7180/7148	Read/Write	User float 7 / PI #1 ACF Low Limit		G.O./P.I.
328	8217	7181/7149	Read/Write	User float 8 / PI #1 ACF High Limit		G.O./P.I.
329	8218	7182/7004	Read/Write	User float 9 / Current Uncorrected Flow		G.O./P.I.
330	8219	7183	Read/Write	User float 10		
331	8220	7184	Read/Write	User float 11		
332	8221	7185	Read/Write	User float 12		
333	8222	7186	Read/Write	User float 13		
334	8223	7187	Read/Write	User float 14		
335	8224	7188	Read/Write	User float 15		
336	8225	7189	Read/Write	User float 16		
337	8226	7190	Read/Write	User float 17		
338	8227	7191	Read/Write	User float 18		
339	8228	7192	Read/Write	User float 19		
340	8229	7193	Read/Write	User float 20		
341	8230	7194	Read/Write	User float 21		
342	8231	7195	Read/Write	User float 22		
343	8232	7196	Read/Write	User float 23		
344	8233	7197	Read/Write	User float 24		
345	8234	7198	Read/Write	User float 25		
346	8235	7199	Read/Write	User float 26		
347	8236	7200	Read/Write	User float 27		

Poll Group 4 (cont.)

348	8237	7201	Read/Write	User float 28		
349	8238	7202	Read/Write	User float 29		
350	8239	7203	Read/Write	User float 30		
351	8240	7204	Read/Write	User float 31		
352	8241	7205	Read/Write	User float 32		
353	8242	7206	Read/Write	User float 33		
354	8243	7207	Read/Write	User float 34		
355	8244	7208	Read/Write	User float 35		
356	8245	7209	Read/Write	User float 36		
357	8246	7210	Read/Write	User float 37		
358	8247	7211	Read/Write	User float 38		

XVIII. Discrete Outputs -- General

There are two on-board discrete outputs(DO's) available on the 6700 series flow computer, and an additional four DO's may be obtained by using a valve control interface(VCI) termination board (AAI part 2012826). There are some differences in how the different sets of DO's work and restrictions on how they may be used, all of which will be discussed in this section.

DO 1 and DO 2 are the on-board DO's, and in the PG&E protocol are accesed through registers 3188 and 3189 respectively. *IMPORTANT:* For these DO's to operate correctly for this protocol two variables must be set through the local interface – DO1=64 and DO2=64. If these variables are not set and a command is sent to turn on the DO, it will not time out and will remain 'On' indefinitely. A restriction for the on-board DO's is that they can not be selected as the
Push-to-Talk DO. How these DO's operate will be discussed after an introduction to the VCI DO's.
The four VCI term board DO's require no special user setup and all are candidates for the
Push-to-Talk feature. These DO's are referred to as VCI DO 1, VCI DO 2, VCI DO3, and
VCI DO 4 and are accessed through registers 3190, 3191, 3192, and 3193 respectively.

The operation of all the DO's is dependent upon the method in which they are accessed. If accessed through a Poll Group write by entering a '1' in the desired bit position for the chosen DO, the selected DO(s) will remain on for a default of 15 seconds. To determine which bit position corresponds to which DO, see the examples in the section titled "PG&E Poll Group Protocol". When a DO is selected for a Block operation write, the value of the "Time On" parameter will determine how long the DO stays activated. If a "Time On" value of zero is entered in this field, the DO will turn on for a default of 15 seconds. If accessing a DO through its individual register number (i.e. 3190) for a write operation, a value of zero will turn on the DO for a default of 15 seconds. Otherwise, the value entered is the time for the DO to remain on.

XIX. Push-to-Talk Discrete Output

The Push-to-Talk(PTT) DO is a DO which has been selected to follow the request to send(RTS) line for a given port. Only one DO may be selected as the PTT DO for any one port. Other ports may use different DO's as the Push-to-Talk or may choose to use one DO for all ports. A DO which has been selected as the PTT DO can not be accessed by any other method than to follow the RTS line. The following table shows the bit weight and corresponding parameter. To select a DO and its associated port, add the corresponding bit weights and enter the value locally with the "RTSD=xx" command, or remotely with a write to register 3194.

Bit Weight	*Parameter*
1	VCI DO 1
2	VCI DO 2
4	VCI DO 3
8	VCI DO 4
16	Remote Port RTS
32	Aux Port RTS
64	AuxB Port RTS

To select VCI DO 1 to follow the RTS line on the Aux port, a value of 33 (32 + 1) would be entered. Once a DO has been selected to follow the RTS line for a given port, it will always follow until another DO has been designated to follow on that port. To reset the Push-to-Talk option so that no DO's will follow any RTS line enter a value of zero.

XX. New Local Commands

Several new commands have been added to the local interface which allow for accessing some of the new parameters in the PG&E protocol. The following table outlines these commands and also lists the register associated with that variable if it is possible to also set the value remotely.

Command	Purpose	Register
RSPT	Reset Point Type Table to Factory Defaults	1191
RSPG	Reset Poll Group Table to Factory Defaults	1192
RTSD	Select Discrete Output and port to Follow RTS Line	3194
MNTH	Set Month (i.e. 1 = January, 2 = February, etc.)	3195
DAY	Set Day of Month	3196
YEAR	Set Year (two digits, 1999 = 99)	3197
HOUR	Set Hour	3198
MIN	Set Minutes	3199
SEC	Set Seconds	3200
PDO1	Turn On On-Board DO 1 (value = time on, value = 0 'on' 15 sec)	3188
PDO2	Turn On On-Board DO 2	3189
PVC1	Turn On VCI DO 1	3190
PVC2	Turn On VCI DO 2	3191
PVC3	Turn On VCI DO 3	3192
PVC4	Turn On VCI DO 4	3193
SWS	Valve Control Switch Status(1=Primary, 2=DP Ovrd, 3= SP Ovrd	3219

The first two commands, RSPT and RSPG, reset when a value of 1 is written to them.

XXI. PG&E Block Protocol

Point Type Definition:

There are 12 basic point types which are required for the PG&E project. These are basically structures of Modbus data which may be read or written to in blocks. They consist of a varying number of parameters, and different data types exist within each block. PG&E requested that these should be configurable. The decided upon instances of these point types is as follows:

Point Type	Parameter	# in Design Process
1	Discrete Inputs	6
2	Discrete Outputs	6
3	Analog Inputs	2
4	Analog Outputs	4
5	Pulse Inputs	2
6	PID Parameters	3
7	AGA Flow Parameters	1
10	AGA Flow Values	1
12	Clock	1
14	Communication Port	3
15	System Variables	1
34	User Config	1

Several methods to implement a table to house these types were discussed in the design phase of the project. The method decided upon was to have 60 parameters for each Point Type entry which would be user configurable. 60 was chosen because the largest Point Type, AGA Flow Parameters, had 54 entries. This would allow some flexibility for configuring it and lots of flexibility in configuring the other Point Types. By having a fixed number of entries, accessing the table in partition RAM was simplified.

Outline:

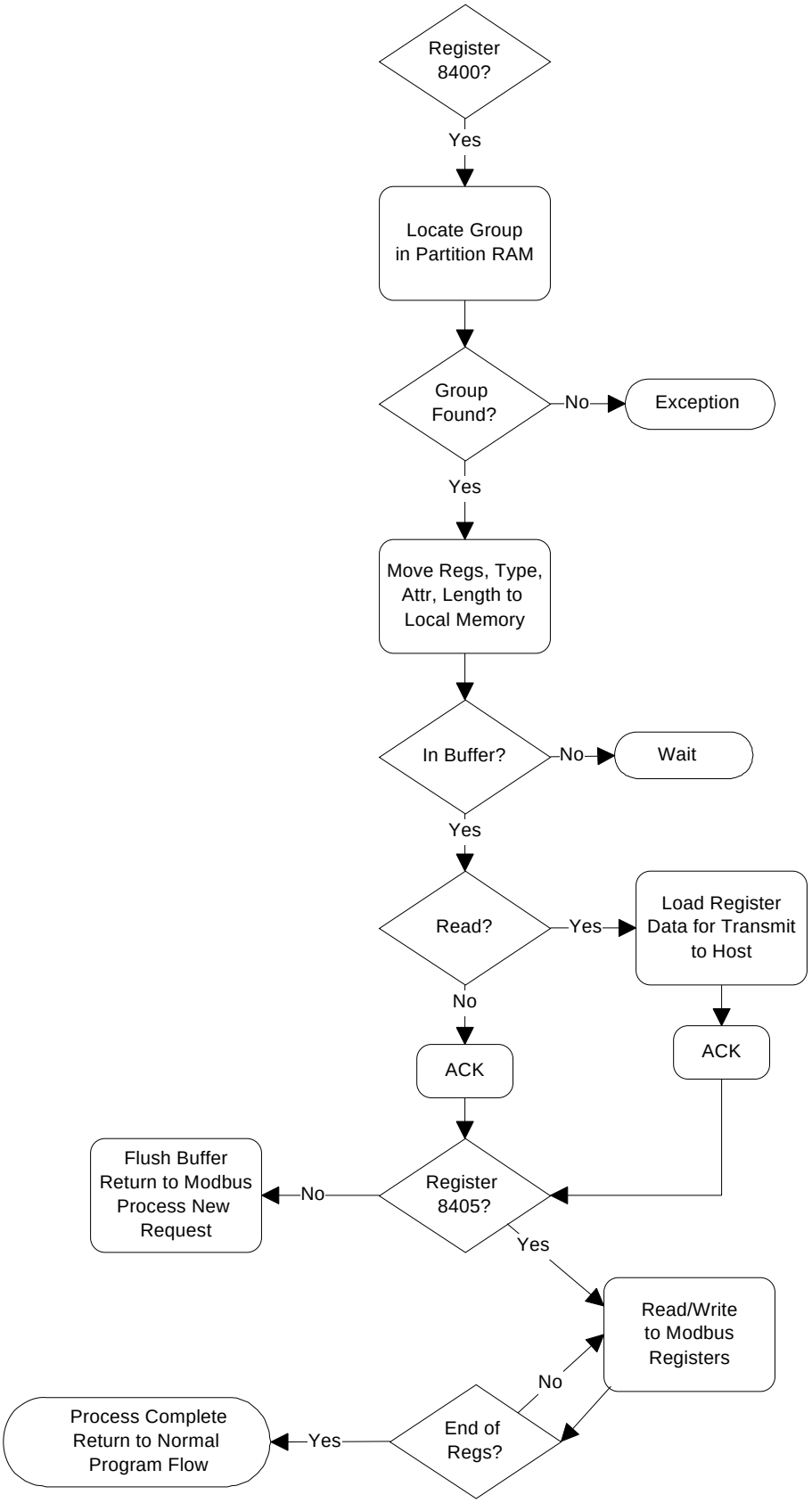
Modbus will operate as usual until it is found that the host wants to do a write to register 8400. This will signal the system that a block operation is going to take place. A routine will be called to go locate the information needed in partition RAM based on what the host has written to registers 8400 – 8404. If the proper point type is not found, return an exception response. If it is found, move this data into a storage buffer. The data will consist of the register number, data type, attributes, and the length as specified in the documentation provided by PG&E.

If the operation is to be a write, this Point Type information is restored out in the PGEDATA area in partition RAM and the FCU will ACK the host. The host response should be an access to register 8405 for a write operation. If it is not, the block operation will be canceled and the new request will be processed. Otherwise, the data to be changed is received from the host and the FCU will use the information that was stored in PGEDATA RAM to place the data into the proper registers.

If the operation is to be a read, the FCU processes the header file information and load the register data before sending an ACK to the host. This process takes a little while, so this fact should be kept in mind when setting up communication parameters such as timeout.

On the following page is a flowchart which gives a visual idea of this process.

Design Flowchart



ASCII Character Type:

Point Type parameters which are of this type are modifiable through the Block operation of the host. In FCU memory, each string is allotted a size of 30, however, the host may restrict this to a different size. The host does its' own boundary checking, and the FCU will not allow more than 30 characters for data whose type is AC.

Customization:

The arrangement of the entries in each Point Type may be changed by the user. Referring to the tables in section XXI. Point Type Tables, there are four parts, or sub-parms, to each Point Type parameter which are used in the operating code – Type, Length, Attributes, and RAM. RAM is the physical location of each sub-parm. The sub-parms reside in the partition RAM area of the flow computer and are accessed through two-byte registers which begin at 20,001. Each Point Type table lists these registers for the first two parameters and provides some help at determining the others by references at every fifth parameter. When connecting with ModScan to modify these tables, the protocol should be Standard RTU.

To customize a Point Type, the sub-parms must be accessed through register writes. This may be accomplished through the use of ModScan32 (available for less than $100 at www.win-tech.com). With this application the user can view the register contents as they are being modified and the results of the change are also visible at the same time. This allows for a more convenient and less error prone method of entry. For an example of customizing the Point Types this way, consider that the user wishes to change the format of Point Type 2, Discrete Output Parameters, for DO 1 so that the "Time On" parameter switches positions with the "Status" parameter. The pertinent information for these two parameters is looked up in the corresponding Point Type table and is found to be the following:

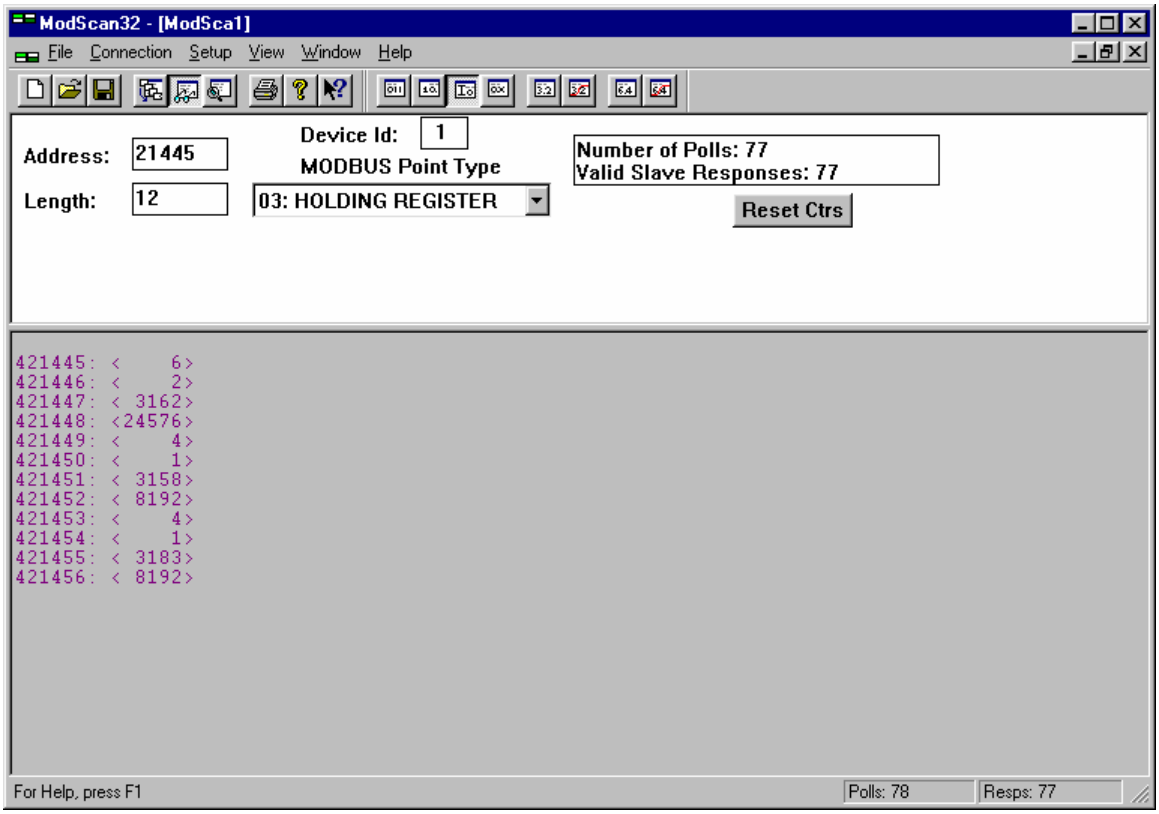
Time On

Variable	*Location*	*Data*
Type	21445	UI
Length	21446	2
Register	21447	3188
Attribute	21448	Read|Write

Status

Variable	*Location*	*Data*
Type	21453	UC
Length	21454	1
Register	21455	3209
Attribute	21456	Read

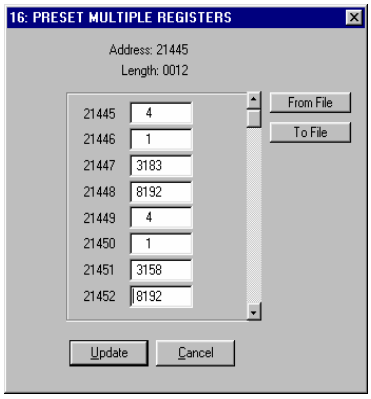
Given this information it is now possible to reverse the positions of these parameters. By selecting to read holding registers beginning at 21445 for a total of 12 registers these two parameters would then be in the scope of that read and their current values would be displayed as shown below.

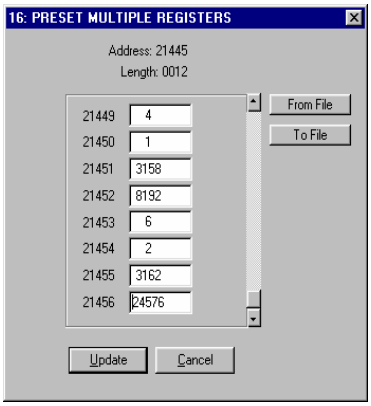


Note: The registers in slots 5 – 8 would be the sub-parms associated with parameter #2, “Spare”.

Before entering any data values, a few conversions must be performed at this point. By referencing the “Data Type” table convert the “Type” variables above to their equivalent decimal representation (UI = 6, and UC = 4). These are the values which will be written into the appropriate register later. Also, referring to the “Attributes” table convert the attributes to their equivalence (Read|Write = 24576, and Read = 8192).

Now, by selecting to preset registers off of the Setup| Extended|Preset Regs menu, the actual data entry to swap the desired parameters can take place. The screens below show this option with the data in the proper format ready to be sent to the FCU to make the swap of the two parameters.





Important:
It should be noted that when performing this operation of swapping two unlike types that the results were unsuccessful with the Host_Sim program because the host was still expecting the original data type. This is a limitation on the host side. Swaps were accepted by the host if the data type of the register being moved was the same as was there previously. For example swapping the Point Tag ID parameter and the Units parameter. Both are of the same type and size so the swap was successful. This shows that the flow computer can perform the customization of the Point Type tables, but it is also up to the host to be configurable for these changes to be truly global in their application. Even though the Units parameter was moved into parameter slot 0, the host still labeled this parameter as Point Tag ID.

For parameters which are not required to return meaningful values, such as “Spare” parameters, a set of NULL registers has been created which will return a 0 (zero) of the proper format for their data type. These can be referenced in the “NULL Register” table.

Important:
Remember that each sub-parm occupies two bytes and the Modbus protocol only allows the transfer of a maximum of 256 bytes for each transaction.

XXII. Point Type Table Definitions

Data Types

Data Type	Value	Definition
BN	0	Binary
AC	1	ASCII Character
CH	2	Single ASCII Character
SC	3	Signed Character
UC	4	Unsigned Character
PGE_SI	5	Signed Integer
UI	6	Unsigned Integer
SL	7	Signed Long Integer
UL	8	Unsigned Long Integer
FL	9	Floating Point (IEEE)
TLP	10	Type, Point Number, and Parameter Number
TM	11	Six Byte Time Variable

Attributes

Attribute	Value
Read Only	8192
Read and Write	24576

NULL Registers

Register	Description
3184	NULL Character Register
3185	NULL ASCII Register
3186	NULL Integer Register
3187	NULL Binary Register
5026	NULL Long Integer Register
7334	NULL Floating Point Register

Point Type 1, Discrete Input #1 Parameters

Type	Length	Register	Attributes	Description	Parm	RAM Type Length Reg Attr	Meter Type
AC	10	30001	READ|WRITE	Tag id	0	20001 0002 0003 0004	
UC	1	3184	READ	Not Used	1	20005 0006 0007 0008	
UC	1	3203	READ	Status (0=off 1=on)	2		
UC	1	3184	READ	Not Used	3		
UC	1	3184	READ	Not Used	4	0020	
UL	4	5026	READ	Not Used	5		
UL	4	5026	READ	Not Used	6		
UL	4	5026	READ	Not Used	7		
UI	2	3186	READ	Not Used	8		
UI	2	3186	READ	Not Used	9	0040	
UI	2	3186	READ	Not Used	10		
AC	10	30661	READ|WRITE	Units	11		
UI	2	3186	READ	Not Used	12		
FL	4	7334	READ	Not Used	13		
FL	4	7334	READ	Not Used	14	0060	
FL	4	7334	READ	Not Used	15		
FL	4	7334	READ	Not Used	16		
FL	4	7334	READ	Not Used	17		
FL	4	7334	READ	Not Used	18		
FL	4	7334	READ	Not Used	19	0080	
FL	4	7334	READ	Not Used	20		
FL	4	7334	READ	Not Used	21		
UI	2	3186	READ	Not Used	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	0100	
FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	0120	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	0140	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	0160	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	0180	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	0200	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		

Discrete Input #1 (cont.)

FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	0220	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	0240	

Point Type 1, Discrete Input #2 Parameters

Type	Length	Register	Attributes	Description	Parm	RAM Type Length Reg Attr	Meter Type
AC	10	30016	READ|WRITE	Tag id	0	20241 0242 0243 0244	
UC	1	3184	READ	Not Used	1	20245 0246 0247 0248	
UC	1	3204	READ	Status (0=off 1=on)	2		
UC	1	3184	READ	Not Used	3		
UC	1	3184	READ	Not Used	4	0260	
UL	4	5026	READ	Not Used	5		
UL	4	5026	READ	Not Used	6		
UL	4	5026	READ	Not Used	7		
UI	2	3186	READ	Not Used	8		
UI	2	3186	READ	Not Used	9	0280	
UI	2	3186	READ	Not Used	10		
AC	10	30676	READ|WRITE	Units	11		
UI	2	3186	READ	Not Used	12		
FL	4	7334	READ	Not Used	13		
FL	4	7334	READ	Not Used	14	0300	
FL	4	7334	READ	Not Used	15		
FL	4	7334	READ	Not Used	16		
FL	4	7334	READ	Not Used	17		
FL	4	7334	READ	Not Used	18		
FL	4	7334	READ	Not Used	19	0320	
FL	4	7334	READ	Not Used	20		
FL	4	7334	READ	Not Used	21		
UI	2	3186	READ	Not Used	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	0340	
FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	0360	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	0380	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		

Discrete Input # 2 (cont.)

FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	0400	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	0420	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	0440	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	0460	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	0480	

Point Type 1, Discrete Input #3 Parameters

Type	Length	Register	Attributes	Description	Parm	RAM Type Length Reg Attr	Meter Type
AC	10	30031	READ|WRITE	Tag id	0	20481 0482 0483 0484	
UC	1	3184	READ	Not Used	1	20485 0486 0487 0488	
UC	1	3205	READ	Status (0=off 1=on)	2		
UC	1	3184	READ	Not Used	3		
UC	1	3184	READ	Not Used	4	0500	
UL	4	5026	READ	Not Used	5		
UL	4	5026	READ	Not Used	6		
UL	4	5026	READ	Not Used	7		
UI	2	3186	READ	Not Used	8		
UI	2	3186	READ	Not Used	9	0520	
UI	2	3186	READ	Not Used	10		
AC	10	30691	READ|WRITE	Units	11		
UI	2	3186	READ	Not Used	12		
FL	4	7334	READ	Not Used	13		
FL	4	7334	READ	Not Used	14	0540	
FL	4	7334	READ	Not Used	15		
FL	4	7334	READ	Not Used	16		
FL	4	7334	READ	Not Used	17		
FL	4	7334	READ	Not Used	18		
FL	4	7334	READ	Not Used	19	0560	
FL	4	7334	READ	Not Used	20		
FL	4	7334	READ	Not Used	21		
UI	2	3186	READ	Not Used	22		
FL	4	7334	READ	Spare	23		

Discrete Input #3 (cont.)

FL	4	7334	READ	Spare	24	0580	
FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	0600	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	0620	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	0640	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	0660	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	0680	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	0700	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	0720	

Point Type 1, Discrete Input #4 Parameters

Type	Length	Register	Attributes	Description	Parm	RAM Type Length Reg Attr	Meter Type
AC	10	30046	READ|WRITE	Tag id	0	20721 0722 0723 0724	
UC	1	3184	READ	Not Used	1	20725 0726 0727 0728	
UC	1	3206	READ	Status (0=off 1=on)	2		
UC	1	3184	READ	Not Used	3		
UC	1	3184	READ	Not Used	4	0740	
UL	4	5026	READ	Not Used	5		
UL	4	5026	READ	Not Used	6		
UL	4	5026	READ	Not Used	7		
UI	2	3186	READ	Not Used	8		
UI	2	3186	READ	Not Used	9	0760	

Discrete Input #4 (cont.)

UI	2	3186	READ	Not Used	10		
AC	10	30705	READ|WRITE	Units	11		
UI	2	3186	READ	Not Used	12		
FL	4	7334	READ	Not Used	13		
FL	4	7334	READ	Not Used	14	0780	
FL	4	7334	READ	Not Used	15		
FL	4	7334	READ	Not Used	16		
FL	4	7334	READ	Not Used	17		
FL	4	7334	READ	Not Used	18		
FL	4	7334	READ	Not Used	19	0800	
FL	4	7334	READ	Not Used	20		
FL	4	7334	READ	Not Used	21		
UI	2	3186	READ	Not Used	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	0820	
FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	0840	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	0860	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	0880	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	0900	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	0920	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	0940	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	0960	

Point Type 1, Discrete Input #5 Parameters

Type	Length	Register	Attributes	Description	Parm	RAM Type	RAM Length	RAM Reg	RAM Attr	Meter Type
AC	10	30061	READ|WRITE	Tag id	0	20961	0962	0963	0964	
UC	1	3184	READ	Not Used	1	20965	0966	0967	0968	
UC	1	3207	READ	Status (0=off 1=on)	2					
UC	1	3184	READ	Not Used	3					
UC	1	3184	READ	Not Used	4				0980	
UL	4	5026	READ	Not Used	5					
UL	4	5026	READ	Not Used	6					
UL	4	5026	READ	Not Used	7					
UI	2	3186	READ	Not Used	8					
UI	2	3186	READ	Not Used	9				1000	
UI	2	3186	READ	Not Used	10					
AC	10	30721	READ|WRITE	Units	11					
UI	2	3186	READ	Not Used	12					
FL	4	7334	READ	Not Used	13					
FL	4	7334	READ	Not Used	14				1020	
FL	4	7334	READ	Not Used	15					
FL	4	7334	READ	Not Used	16					
FL	4	7334	READ	Not Used	17					
FL	4	7334	READ	Not Used	18					
FL	4	7334	READ	Not Used	19				1040	
FL	4	7334	READ	Not Used	20					
FL	4	7334	READ	Not Used	21					
UI	2	3186	READ	Not Used	22					
FL	4	7334	READ	Spare	23					
FL	4	7334	READ	Spare	24				1060	
FL	4	7334	READ	Spare	25					
FL	4	7334	READ	Spare	26					
FL	4	7334	READ	Spare	27					
FL	4	7334	READ	Spare	28					
FL	4	7334	READ	Spare	29				1080	
FL	4	7334	READ	Spare	30					
FL	4	7334	READ	Spare	31					
FL	4	7334	READ	Spare	32					
FL	4	7334	READ	Spare	33					
FL	4	7334	READ	Spare	34				1100	
FL	4	7334	READ	Spare	35					
FL	4	7334	READ	Spare	36					
FL	4	7334	READ	Spare	37					
FL	4	7334	READ	Spare	38					
FL	4	7334	READ	Spare	39				1120	
FL	4	7334	READ	Spare	40					
FL	4	7334	READ	Spare	41					
FL	4	7334	READ	Spare	42					
FL	4	7334	READ	Spare	43					
FL	4	7334	READ	Spare	44				1140	
FL	4	7334	READ	Spare	45					
FL	4	7334	READ	Spare	46					
FL	4	7334	READ	Spare	47					
FL	4	7334	READ	Spare	48					
FL	4	7334	READ	Spare	49				1160	
FL	4	7334	READ	Spare	50					
FL	4	7334	READ	Spare	51					
FL	4	7334	READ	Spare	52					

Discrete Input #5 (cont.)

FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	1180	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	1200	

Point Type 1, Discrete Input #6 Parameters

Type	Length	Register	Attributes	Description	Parm	RAM Type Length Reg Attr	Meter Type
AC	10	30076	READ|WRITE	Tag id	0	21201 1202 1203 1204	
UC	1	3184	READ	Not Used	1	21205 1206 1207 1208	
UC	1	3208	READ	Status (0=off 1=on)	2		
UC	1	3184	READ	Not Used	3		
UC	1	3184	READ	Not Used	4	1220	
UL	4	5026	READ	Not Used	5		
UL	4	5026	READ	Not Used	6		
UL	4	5026	READ	Not Used	7		
UI	2	3186	READ	Not Used	8		
UI	2	3186	READ	Not Used	9	1240	
UI	2	3186	READ	Not Used	10		
AC	10	30736	READ|WRITE	Units	11		
UI	2	3186	READ	Not Used	12		
FL	4	7334	READ	Not Used	13		
FL	4	7334	READ	Not Used	14	1260	
FL	4	7334	READ	Not Used	15		
FL	4	7334	READ	Not Used	16		
FL	4	7334	READ	Not Used	17		
FL	4	7334	READ	Not Used	18		
FL	4	7334	READ	Not Used	19	1280	
FL	4	7334	READ	Not Used	20		
FL	4	7334	READ	Not Used	21		
UI	2	3186	READ	Not Used	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	1300	
FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	1320	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	1340	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		

Discrete Input #6 (cont.)

FL	4	7334	READ	Spare	39	1360	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	1380	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	1400	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	1420	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	1440	

Point Type 2, Discrete Output #1

Type	Length	Register	Attributes	Description	Parm	RAM Type Length Reg Attr	Meter Type
AC	10	30091	READ|WRITE	Tag ID	0	21441 1442 1443 1444	
UI	2	3188	READ|WRITE	Time On	1	21445 1446 1447 1448	
UC	1	3184	READ	Spare	2		
UC	1	3209	READ	Status (0=off 1=on)	3		
UC	1	3184	READ	Not Used	4	1460	
UC	1	3184	READ	Not Used	5		
UL	4	5026	READ	Not Used	6		
AC	10	30751	READ|WRITE	Units	7		
UI	2	3186	READ	Not Used	8		
UI	2	3186	READ	Not Used	9	1480	
UI	2	3186	READ	Not Used	10		
FL	4	7334	READ	Not Used	11		
FL	4	7334	READ	Not Used	12		
FL	4	7334	READ	Not Used	13		
FL	4	7334	READ	Spare	14	1500	
FL	4	7334	READ	Spare	15		
FL	4	7334	READ	Spare	16		
FL	4	7334	READ	Spare	17		
FL	4	7334	READ	Spare	18		
FL	4	7334	READ	Spare	19	1520	
FL	4	7334	READ	Spare	20		
FL	4	7334	READ	Spare	21		
FL	4	7334	READ	Spare	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	1540	
FL	4	7334	READ	Spare	25		

Discrete Output #1 (cont.)

FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	1560	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	1580	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	1600	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	1620	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	1640	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	1660	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	1680	

Point Type 2, Discrete Output #2

Type	*Length*	*Register*	*Attributes*	*Description*	*Parm*	*RAM* *Type* *Length* *Reg* *Attr*	*Meter Type*
AC	10	30106	READ|WRITE	Tag ID	0	21681 1682 1683 1684	
UI	2	3189	READ|WRITE	Time On	1	21685 1686 1687 1688	
UC	1	3184	READ	Spare	2		
UC	1	3210	READ	Status (0=off 1=on)	3		
UC	1	3184	READ	Not Used	4	1700	
UC	1	3184	READ	Not Used	5		
UL	4	5026	READ	Not Used	6		
AC	10	30766	READ|WRITE	Units	7		

Discrete Output #2 (cont.)

UI	2	3186	READ	Not Used	8		
UI	2	3186	READ	Not Used	9	1720	
UI	2	3186	READ	Not Used	10		
FL	4	7334	READ	Not Used	11		
FL	4	7334	READ	Not Used	12		
FL	4	7334	READ	Not Used	13		
FL	4	7334	READ	Spare	14	1740	
FL	4	7334	READ	Spare	15		
FL	4	7334	READ	Spare	16		
FL	4	7334	READ	Spare	17		
FL	4	7334	READ	Spare	18		
FL	4	7334	READ	Spare	19	1760	
FL	4	7334	READ	Spare	20		
FL	4	7334	READ	Spare	21		
FL	4	7334	READ	Spare	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	1780	
FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	1800	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	1820	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	1840	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	1860	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	1880	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	1900	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	1920	

Point Type 2, Discrete Output #3

Type	Length	Register	Attributes	Description	Parm	RAM Type	RAM Length	RAM Reg	RAM Attr	Meter Type
AC	10	30121	READ|WRITE	Tag ID	0	21921	1922	1923	1924	
UI	2	3190	READ|WRITE	Time On	1	21925	1926	1927	1928	
UC	1	3184	READ	Spare	2					
UC	1	3211	READ	Status (0=off 1=on)	3					
UC	1	3184	READ	Not Used	4				1940	
UC	1	3184	READ	Not Used	5					
UL	4	5026	READ	Not Used	6					
AC	10	30781	READ|WRITE	Units	7					
UI	2	3186	READ	Not Used	8					
UI	2	3186	READ	Not Used	9				1960	
UI	2	3186	READ	Not Used	10					
FL	4	7334	READ	Not Used	11					
FL	4	7334	READ	Not Used	12					
FL	4	7334	READ	Not Used	13					
FL	4	7334	READ	Spare	14				1980	
FL	4	7334	READ	Spare	15					
FL	4	7334	READ	Spare	16					
FL	4	7334	READ	Spare	17					
FL	4	7334	READ	Spare	18					
FL	4	7334	READ	Spare	19				2000	
FL	4	7334	READ	Spare	20					
FL	4	7334	READ	Spare	21					
FL	4	7334	READ	Spare	22					
FL	4	7334	READ	Spare	23					
FL	4	7334	READ	Spare	24				2020	
FL	4	7334	READ	Spare	25					
FL	4	7334	READ	Spare	26					
FL	4	7334	READ	Spare	27					
FL	4	7334	READ	Spare	28					
FL	4	7334	READ	Spare	29				2040	
FL	4	7334	READ	Spare	30					
FL	4	7334	READ	Spare	31					
FL	4	7334	READ	Spare	32					
FL	4	7334	READ	Spare	33					
FL	4	7334	READ	Spare	34				2060	
FL	4	7334	READ	Spare	35					
FL	4	7334	READ	Spare	36					
FL	4	7334	READ	Spare	37					
FL	4	7334	READ	Spare	38					
FL	4	7334	READ	Spare	39				2080	
FL	4	7334	READ	Spare	40					
FL	4	7334	READ	Spare	41					
FL	4	7334	READ	Spare	42					
FL	4	7334	READ	Spare	43					
FL	4	7334	READ	Spare	44				2100	
FL	4	7334	READ	Spare	45					
FL	4	7334	READ	Spare	46					
FL	4	7334	READ	Spare	47					
FL	4	7334	READ	Spare	48					
FL	4	7334	READ	Spare	49				2120	
FL	4	7334	READ	Spare	50					
FL	4	7334	READ	Spare	51					
FL	4	7334	READ	Spare	52					

Discrete Output #3 (cont.)

FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	2140	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	2160	

Point Type 2, Discrete Output #4

Type	Length	Register	Attributes	Description	Parm	RAM Type Length Reg Attr	Meter Type
AC	10	30136	READ|WRITE	Tag ID	0	22161 2162 2163 2164	
UI	2	3191	READ|WRITE	Time On	1	22165 2166 2167 2168	
UC	1	3184	READ	Spare	2		
UC	1	3212	READ	Status (0=off 1=on)	3		
UC	1	3184	READ	Not Used	4	2180	
UC	1	3184	READ	Not Used	5		
UL	4	5026	READ	Not Used	6		
AC	10	30796	READ|WRITE	Units	7		
UI	2	3186	READ	Not Used	8		
UI	2	3186	READ	Not Used	9	2200	
UI	2	3186	READ	Not Used	10		
FL	4	7334	READ	Not Used	11		
FL	4	7334	READ	Not Used	12		
FL	4	7334	READ	Not Used	13		
FL	4	7334	READ	Spare	14	2220	
FL	4	7334	READ	Spare	15		
FL	4	7334	READ	Spare	16		
FL	4	7334	READ	Spare	17		
FL	4	7334	READ	Spare	18		
FL	4	7334	READ	Spare	19	2240	
FL	4	7334	READ	Spare	20		
FL	4	7334	READ	Spare	21		
FL	4	7334	READ	Spare	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	2260	
FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	2280	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	2300	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		

Discrete Output #4 (cont.)

FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	2320	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	2340	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	2360	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	2380	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	2400	

Point Type 2, Discrete Output #5

Type	*Length*	*Register*	*Attributes*	*Description*	*Parm*	*RAM* *Type* *Length* *Reg* *Attr*	*Meter Type*
AC	10	30151	READ|WRITE	Tag ID	0	22401 2402 2403 2404	
UI	2	3192	READ|WRITE	Time On	1	22405 2406 2407 2408	
UC	1	3184	READ	Spare	2		
UC	1	3213	READ	Status (0=off 1=on)	3		
UC	1	3184	READ	Not Used	4	2420	
UC	1	3184	READ	Not Used	5		
UL	4	5026	READ	Not Used	6		
AC	10	30811	READ|WRITE	Units	7		
UI	2	3186	READ	Not Used	8		
UI	2	3186	READ	Not Used	9	2440	
UI	2	3186	READ	Not Used	10		
FL	4	7334	READ	Not Used	11		
FL	4	7334	READ	Not Used	12		
FL	4	7334	READ	Not Used	13		
FL	4	7334	READ	Spare	14	2460	
FL	4	7334	READ	Spare	15		
FL	4	7334	READ	Spare	16		
FL	4	7334	READ	Spare	17		
FL	4	7334	READ	Spare	18		
FL	4	7334	READ	Spare	19	2480	
FL	4	7334	READ	Spare	20		
FL	4	7334	READ	Spare	21		
FL	4	7334	READ	Spare	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	2500	

Discrete Output #5 (cont.)

FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	2520	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	2540	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	2560	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	2580	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	2600	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	2620	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	2640	

Point Type 2, Discrete Output #6

Type	*Length*	*Register*	*Attributes*	*Description*	*Parm*	*RAM* *Type* *Length* *Reg* *Attr*	*Meter Type*
AC	10	30166	READ|WRITE	Tag ID	0	22641 2642 2643 2644	
UI	2	3193	READ|WRITE	Time On	1	22645 2646 2647 2648	
UC	1	3184	READ	Spare	2		
UC	1	3214	READ	Status (0=off 1=on)	3		
UC	1	3184	READ	Not Used	4	2660	
UC	1	3184	READ	Not Used	5		
UL	4	5026	READ	Not Used	6		
AC	10	30826	READ|WRITE	Units	7		
UI	2	3186	READ	Not Used	8		

Discrete Output #6 (cont.)

UI	2	3186	READ	Not Used	9	2680	
UI	2	3186	READ	Not Used	10		
FL	4	7334	READ	Not Used	11		
FL	4	7334	READ	Not Used	12		
FL	4	7334	READ	Not Used	13		
FL	4	7334	READ	Spare	14	2700	
FL	4	7334	READ	Spare	15		
FL	4	7334	READ	Spare	16		
FL	4	7334	READ	Spare	17		
FL	4	7334	READ	Spare	18		
FL	4	7334	READ	Spare	19	2720	
FL	4	7334	READ	Spare	20		
FL	4	7334	READ	Spare	21		
FL	4	7334	READ	Spare	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	2740	
FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	2760	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	2780	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	2800	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	2820	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	2840	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	2860	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	2880	

Point Type 3, Analog Input #1

Type	Length	Register	Attributes	Description	Parm	RAM Type	RAM Length	RAM Reg	RAM Attr	Meter Type
AC	10	30181	READ|WRITE	Tag ID	0	22881	2882	2883	2884	
AC	10	30841	READ|WRITE	Units	1	22885	2886	2887	2888	
UI	2	3186	READ	Not Used	2					
UI	2	3186	READ	Not Used	3					
UI	2	3186	READ	Not Used	4				2900	
UI	2	3186	READ	Not Used	5					
FL	4	7155	READ	Current AI Value	6					
FL	4	7157	READ	Current AI Volts	7					
FL	4	7334	READ	Not Used	8					
FL	4	7334	READ	Not Used	9				2920	
FL	4	7334	READ	Not Used	10					
FL	4	7334	READ	Not Used	11					
FL	4	7334	READ	Not Used	12					
FL	4	7334	READ	Not Used	13					
FL	4	7334	READ	Not Used	14				2940	
UC	1	3184	READ	Not Used	15					
UC	1	3184	READ	Not Used	16					
UI	2	3186	READ	Not Used	17					
UI	2	3186	READ	Not Used	18					
FL	4	7334	READ	Spare	19				2960	
FL	4	7334	READ	Spare	20					
FL	4	7334	READ	Spare	21					
FL	4	7334	READ	Spare	22					
FL	4	7334	READ	Spare	23					
FL	4	7334	READ	Spare	24				2980	
FL	4	7334	READ	Spare	25					
FL	4	7334	READ	Spare	26					
FL	4	7334	READ	Spare	27					
FL	4	7334	READ	Spare	28					
FL	4	7334	READ	Spare	29				3000	
FL	4	7334	READ	Spare	30					
FL	4	7334	READ	Spare	31					
FL	4	7334	READ	Spare	32					
FL	4	7334	READ	Spare	33					
FL	4	7334	READ	Spare	34				3020	
FL	4	7334	READ	Spare	35					
FL	4	7334	READ	Spare	36					
FL	4	7334	READ	Spare	37					
FL	4	7334	READ	Spare	38					
FL	4	7334	READ	Spare	39				3040	
FL	4	7334	READ	Spare	40					
FL	4	7334	READ	Spare	41					
FL	4	7334	READ	Spare	42					
FL	4	7334	READ	Spare	43					
FL	4	7334	READ	Spare	44				3060	
FL	4	7334	READ	Spare	45					
FL	4	7334	READ	Spare	46					
FL	4	7334	READ	Spare	47					
FL	4	7334	READ	Spare	48					
FL	4	7334	READ	Spare	49				3080	
FL	4	7334	READ	Spare	50					
FL	4	7334	READ	Spare	51					

Analog Input #1 (cont.)

FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	3100	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	3120	

Point Type 3, Analog Input #2

Type	Length	Register	Attributes	Description	Parm	RAM Type	RAM Length	RAM Reg	RAM Attr	Meter Type
AC	10	30196	READ|WRITE	Tag ID	0	23121	3122	3123	3124	
AC	10	30856	READ|WRITE	Units	1	23125	3126	3127	3128	
UI	2	3186	READ	Not Used	2					
UI	2	3186	READ	Not Used	3					
UI	2	3186	READ	Not Used	4				3140	
UI	2	3186	READ	Not Used	5					
FL	4	7156	READ	Current AI Value EU	6					
FL	4	7158	READ	Current AI Volts	7					
FL	4	7334	READ	Not Used	8					
FL	4	7334	READ	Not Used	9				3160	
FL	4	7334	READ	Not Used	10					
FL	4	7334	READ	Not Used	11					
FL	4	7334	READ	Not Used	12					
FL	4	7334	READ	Not Used	13					
FL	4	7334	READ	Not Used	14				3180	
UC	1	3184	READ	Not Used	15					
UC	1	3184	READ	Not Used	16					
UI	2	3186	READ	Not Used	17					
UI	2	3186	READ	Not Used	18					
FL	4	7334	READ	Spare	19				3200	
FL	4	7334	READ	Spare	20					
FL	4	7334	READ	Spare	21					
FL	4	7334	READ	Spare	22					
FL	4	7334	READ	Spare	23					
FL	4	7334	READ	Spare	24				3220	
FL	4	7334	READ	Spare	25					
FL	4	7334	READ	Spare	26					
FL	4	7334	READ	Spare	27					
FL	4	7334	READ	Spare	28					
FL	4	7334	READ	Spare	29				3240	
FL	4	7334	READ	Spare	30					
FL	4	7334	READ	Spare	31					
FL	4	7334	READ	Spare	32					
FL	4	7334	READ	Spare	33					
FL	4	7334	READ	Spare	34				3260	
FL	4	7334	READ	Spare	35					
FL	4	7334	READ	Spare	36					
FL	4	7334	READ	Spare	37					
FL	4	7334	READ	Spare	38					

Analog Input #2 (cont.)

FL	4	7334	READ	Spare	39	3280	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	3300	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	3320	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	3340	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	3360	

Point Type 4, Analog Output #1

Type	Length	Register	Attributes	Description	Parm	RAM Type Length Reg Attr	Meter Type
AC	10	30211	READ|WRITE	Tag ID	0	23361 3362 3363 3364	
AC	10	30871	READ|WRITE	Units	1	23365 3366 3367 3368	
UI	2	3221	READ	Low Cal Point	2		
UI	2	3222	READ	High Cal Point	3		
FL	4	7343	READ	Low Reading EU	4	3380	
FL	4	7344	READ	High Reading EU	5		
FL	4	7345	READ	Value in EUs	6		
UC	1	3229	READ|WRITE	Mode	7		
UC	1	3184	READ	Not Used	8		
UI	2	3186	READ	Not Used	9	3400	
FL	4	7334	READ	Spare	10		
FL	4	7334	READ	Spare	11		
FL	4	7334	READ	Spare	12		
FL	4	7334	READ	Spare	13		
FL	4	7334	READ	Spare	14	3420	
FL	4	7334	READ	Spare	15		
FL	4	7334	READ	Spare	16		
FL	4	7334	READ	Spare	17		
FL	4	7334	READ	Spare	18		
FL	4	7334	READ	Spare	19	3440	
FL	4	7334	READ	Spare	20		
FL	4	7334	READ	Spare	21		
FL	4	7334	READ	Spare	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	3460	

Analog Output #1 (cont.)

FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	3480	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	3500	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	3520	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	3540	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	3560	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	3580	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	3600	

Point Type 4, Analog Output #2

Type	*Length*	*Register*	*Attributes*	*Description*	*Parm*	*RAM* *Type* *Length* *Reg* *Attr*	*Meter Type*
AC	10	30226	READ|WRITE	Tag ID	0	23601 3602 3603 3604	
AC	10	30886	READ|WRITE	Units	1	23605 3606 3607 3608	
UI	2	3223	READ	Low Cal Point	2		
UI	2	3224	READ	High Cal Point	3		
FL	4	7346	READ	Low Reading EU	4	3620	
FL	4	7347	READ	High Reading EU	5		
FL	4	7348	READ	Value in EUs	6		
UC	1	3230	READ|WRITE	Mode	7		
UC	1	3184	READ	Not Used	8		
UI	2	3186	READ	Not Used	9	3640	

Analog Output #2 (cont.)

FL	4	7334	READ	Spare	10		
FL	4	7334	READ	Spare	11		
FL	4	7334	READ	Spare	12		
FL	4	7334	READ	Spare	13		
FL	4	7334	READ	Spare	14	3660	
FL	4	7334	READ	Spare	15		
FL	4	7334	READ	Spare	16		
FL	4	7334	READ	Spare	17		
FL	4	7334	READ	Spare	18		
FL	4	7334	READ	Spare	19	3680	
FL	4	7334	READ	Spare	20		
FL	4	7334	READ	Spare	21		
FL	4	7334	READ	Spare	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	3700	
FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	3720	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	3740	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	3760	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	3780	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	3800	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	3820	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	3840	

Point Type 4, Analog Output #3

Type	Length	Register	Attributes	Description	Parm	RAM Type	RAM Length	RAM Reg	RAM Attr	Meter Type
AC	10	30241	READ|WRITE	Tag ID	0	23841	3842	3843	3844	
AC	10	30901	READ|WRITE	Units	1	23845	3846	3847	3848	
UI	2	3225	READ	Low Cal Point	2					
UI	2	3226	READ	High Cal point	3					
FL	4	7349	READ	Low Reading EU	4				3860	
FL	4	7350	READ	High Reading EU	5					
FL	4	7351	READ	Value in Eus	6					
UC	1	3231	READ|WRITE	Mode	7					
UC	1	3184	READ	Not Used	8					
UI	2	3186	READ	Not Used	9				3880	
FL	4	7334	READ	Spare	10					
FL	4	7334	READ	Spare	11					
FL	4	7334	READ	Spare	12					
FL	4	7334	READ	Spare	13					
FL	4	7334	READ	Spare	14				3900	
FL	4	7334	READ	Spare	15					
FL	4	7334	READ	Spare	16					
FL	4	7334	READ	Spare	17					
FL	4	7334	READ	Spare	18					
FL	4	7334	READ	Spare	19				3920	
FL	4	7334	READ	Spare	20					
FL	4	7334	READ	Spare	21					
FL	4	7334	READ	Spare	22					
FL	4	7334	READ	Spare	23					
FL	4	7334	READ	Spare	24				3940	
FL	4	7334	READ	Spare	25					
FL	4	7334	READ	Spare	26					
FL	4	7334	READ	Spare	27					
FL	4	7334	READ	Spare	28					
FL	4	7334	READ	Spare	29				3960	
FL	4	7334	READ	Spare	30					
FL	4	7334	READ	Spare	31					
FL	4	7334	READ	Spare	32					
FL	4	7334	READ	Spare	33					
FL	4	7334	READ	Spare	34				3980	
FL	4	7334	READ	Spare	35					
FL	4	7334	READ	Spare	36					
FL	4	7334	READ	Spare	37					
FL	4	7334	READ	Spare	38					
FL	4	7334	READ	Spare	39				4000	
FL	4	7334	READ	Spare	40					
FL	4	7334	READ	Spare	41					
FL	4	7334	READ	Spare	42					
FL	4	7334	READ	Spare	43					
FL	4	7334	READ	Spare	44				4020	
FL	4	7334	READ	Spare	45					
FL	4	7334	READ	Spare	46					
FL	4	7334	READ	Spare	47					
FL	4	7334	READ	Spare	48					
FL	4	7334	READ	Spare	49				4040	
FL	4	7334	READ	Spare	50					
FL	4	7334	READ	Spare	51					

Analog Output #3 (cont.)

FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	4060	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	4080	

Point Type 4, Analog Output #4

Type	Length	Register	Attributes	Description	Parm	RAM Type	RAM Length	RAM Reg	RAM Attr	Meter Type
AC	10	30256	READ|WRITE	Tag ID	0	24081	4082	4083	4084	
AC	10	30916	READ|WRITE	Units	1	24085	4086	4087	4088	
UI	2	3227	READ	Low Cal Point	2					
UI	2	3228	READ	High Cal point	3					
FL	4	7352	READ	Low Reading EU	4				4100	
FL	4	7353	READ	High Reading EU	5					
FL	4	7354	READ	Value in Eus	6					
UC	1	3232	READ|WRITE	Mode	7					
UC	1	3184	READ	Not Used	8					
UI	2	3186	READ	Not Used	9				4120	
FL	4	7334	READ	Spare	10					
FL	4	7334	READ	Spare	11					
FL	4	7334	READ	Spare	12					
FL	4	7334	READ	Spare	13					
FL	4	7334	READ	Spare	14				4140	
FL	4	7334	READ	Spare	15					
FL	4	7334	READ	Spare	16					
FL	4	7334	READ	Spare	17					
FL	4	7334	READ	Spare	18					
FL	4	7334	READ	Spare	19				4160	
FL	4	7334	READ	Spare	20					
FL	4	7334	READ	Spare	21					
FL	4	7334	READ	Spare	22					
FL	4	7334	READ	Spare	23					
FL	4	7334	READ	Spare	24				4180	
FL	4	7334	READ	Spare	25					
FL	4	7334	READ	Spare	26					
FL	4	7334	READ	Spare	27					
FL	4	7334	READ	Spare	28					
FL	4	7334	READ	Spare	29				4200	
FL	4	7334	READ	Spare	30					
FL	4	7334	READ	Spare	31					
FL	4	7334	READ	Spare	32					
FL	4	7334	READ	Spare	33					
FL	4	7334	READ	Spare	34				4220	
FL	4	7334	READ	Spare	35					
FL	4	7334	READ	Spare	36					

Analog Output #4 (cont.)

FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	4240	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	4260	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	4280	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	4300	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	4320	

Point Type 5, Pulse Input #1

Type	***Length***	***Register***	***Attributes***	***Description***	***Parm***	***RAM*** ***Type Length Reg Attr***	***Meter Type***
AC	10	30271	READ|WRITE	Tag ID	0	24321 4322 4323 4324	
AC	10	30931	READ|WRITE	Units	1	24325 4326 4327 4328	
UC	1	3184	READ	Not Used	2		
UC	1	3069/3184	READ	Flow Window / NULL	3		G.O./P.I.
UC	1	3184	READ	Not Used	4	4340	
UI	2	3186	READ	Not Used	5		
FL	4	7159	READ|WRITE	Conversion(k Factor)	6		
FL	4	7334/7387	READ|WRITE	NULL / Flow Window	7		G.O./P.I.
FL	4	7334	READ	Not Used	8		
FL	4	7334	READ	Not Used	9	4360	
FL	4	7334	READ	Not Used	10		
FL	4	7334	READ	Not Used	11		
FL	4	7334	READ	Not Used	12		
FL	4	7137	READ	Current Count * Meter Factor	13		
UC	1	3184	READ	Not Used	14	4380	
UC	1	3184	READ	Not Used	15		
UL	4	5017	READ|WRITE	Accumulated Value	16		
FL	4	7334	READ	Not Used	17		
FL	4	7161	READ	Today's Total	18		
FL	4	7163	READ	Yesterday's Total	19	4400	
FL	4	7334	READ	Spare	20		

Pulse Input #1 (cont.)

FL	4	7334	READ	Spare	21		
FL	4	7334	READ	Spare	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	4420	
FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	4440	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	4460	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	4480	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	4500	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	4520	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	4540	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	4560	

Point Type 5, Pulse Input #2

Type	Length	Register	Attributes	Description	Parm	RAM Type	RAM Length	RAM Reg	RAM Attr	Meter Type
AC	10	30286	READ|WRITE	Tag ID	0	24561	4562	4563	4564	
AC	10	30946	READ|WRITE	Units	1	24565	4566	4567	4568	
UC	1	3184	READ	Not Used	2					
UC	1	3069/3184	READ	Flow Window / NULL	3					G.O./P.I.
UC	1	3184	READ	Not Used	4				4580	
UI	2	3186	READ	Not Used	5					
FL	4	7160	READ|WRITE	Conversion(k Factor)	6					
FL	4	7334/7388	READ|WRITE	NULL / Flow Window	7					G.O./P.I.
FL	4	7334	READ	Not Used	8					
FL	4	7334	READ	Not Used	9				4600	
FL	4	7334	READ	Not Used	10					
FL	4	7334	READ	Not Used	11					
FL	4	7334	READ	Not Used	12					
FL	4	7137	READ	Current Count * Meter Factor	13					
UC	1	3184	READ	Not Used	14				4620	
UC	1	3184	READ	Not Used	15					
UL	4	5018	READ|WRITE	Accumulated Value	16					
FL	4	7334	READ	Not Used	17					
FL	4	7162	READ	Today's Total	18					
FL	4	7164	READ	Yesterday's Total	19				4640	
FL	4	7334	READ	Spare	20					
FL	4	7334	READ	Spare	21					
FL	4	7334	READ	Spare	22					
FL	4	7334	READ	Spare	23					
FL	4	7334	READ	Spare	24				4660	
FL	4	7334	READ	Spare	25					
FL	4	7334	READ	Spare	26					
FL	4	7334	READ	Spare	27					
FL	4	7334	READ	Spare	28					
FL	4	7334	READ	Spare	29				4680	
FL	4	7334	READ	Spare	30					
FL	4	7334	READ	Spare	31					
FL	4	7334	READ	Spare	32					
FL	4	7334	READ	Spare	33					
FL	4	7334	READ	Spare	34				4700	
FL	4	7334	READ	Spare	35					
FL	4	7334	READ	Spare	36					
FL	4	7334	READ	Spare	37					
FL	4	7334	READ	Spare	38					
FL	4	7334	READ	Spare	39				4720	
FL	4	7334	READ	Spare	40					
FL	4	7334	READ	Spare	41					
FL	4	7334	READ	Spare	42					
FL	4	7334	READ	Spare	43					
FL	4	7334	READ	Spare	44				4740	
FL	4	7334	READ	Spare	45					
FL	4	7334	READ	Spare	46					
FL	4	7334	READ	Spare	47					
FL	4	7334	READ	Spare	48					
FL	4	7334	READ	Spare	49				4760	
FL	4	7334	READ	Spare	50					

Pulse Input #2 (cont.)

FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	4780	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	4800	

Point Type 6, DP Primary Control PID (G.O.) Uncorrected Volume PID (P.I.)

Type	*Length*	*Register*	*Attributes*	*Descriptiion*	*Parm*	*RAM* *Type*	*Length*	*Reg*	*Attr*	*Meter Type*
AC	10	30301	READ|WRITE	Tag Id	0	24801	4802	4803	4804	
UC	1	3216	READ|WRITE	Reverse Action	1	24805	4806	4807	4808	
UC	1	3219	READ	Switch Status	2					
UI	2	3102	READ|WRITE	Primary Gain	3					
TLP	3	15001	READ|WRITE	Primary Input point	4				4820	
TLP	3	15002	READ|WRITE	Primary Output Point	5					
FL	4	7225	READ|WRITE	Primary High Limit	6					
TLP	3	15003	READ|WRITE	Primary Switch Process Variable	7					
CH	1	3185	READ|WRITE	Not Used	8					
TLP	3	15011	READ|WRITE	Not Used	9				4840	
TLP	3	15011	READ|WRITE	Not Used	10					
FL	4	7225	READ|WRITE	DP Override High Limit	11					
TLP	3	15011	READ|WRITE	Not Used	12					
CH	1	3099	READ|WRITE	Low Battery Action (0=Close 1=Freeze)	13					
FL	4	7227	READ|WRITE	Primary Setpoint	14				4860	
FL	4	7226	READ|WRITE	Primary Low Limit	15					
UI	2	3217	READ|WRITE	Primary loop period	16					
FL	4	7336	READ|WRITE	Control Type	17					
FL	4	7239	READ|WRITE	Low Battery Limit (volts)	18					
FL	4	7337	READ|WRITE	DP Low Time	19				4880	
FL	4	7342	READ	Status	20					
FL	4	7228	READ|WRITE	Primary Deadband	21					
FL	4	7004	READ	Primary Process Variable	22					
FL	4	7335	READ	Analog Valve Position	23					
FL	4	7339	READ|WRITE	DP Override Gain	24				4900	
UI	2	3220	READ|WRITE	Minimum Control Time	25					
FL	4	7227	READ|WRITE	DP Override Setpoint	26					
FL	4	7226	READ|WRITE	DP Override Low Limit	27					
UI	2	3106	READ|WRITE	Step Time	28					
FL	4	7340	READ|WRITE	DP Shut-In Period	29				4920	
FL	4	7341	READ|WRITE	DP Shut-In Time Remaining	30					

DP Primary Control / Uncorrected Volume(cont.)

FL	4	7234	READ|WRITE	Pipe Inner Diameter (inches)	31		
FL	4	7229	READ|WRITE	Pipe Length (feet)	32		
FL	4	7228	READ|WRITE	DP Override Deadband	33		
FL	4	7004	READ	Current DP	34	4940	
FL	4	7240	READ|WRITE	SP Override Limit	35		
FL	4	7241	READ|WRITE	SP Restart	36		
FL	4	7003	READ	Current SP	37		
FL	4	7334	READ|WRITE	Spare	38		
FL	4	7334	READ|WRITE	Spare	39	4960	
FL	4	7334	READ|WRITE	Spare	40		
FL	4	7334	READ|WRITE	Spare	41		
FL	4	7334	READ|WRITE	Spare	42		
FL	4	7334	READ|WRITE	Spare	43		
FL	4	7334	READ|WRITE	Spare	44	4980	
FL	4	7334	READ|WRITE	Spare	45		
FL	4	7334	READ|WRITE	Spare	46		
FL	4	7334	READ|WRITE	Spare	47		
FL	4	7334	READ|WRITE	Spare	48		
FL	4	7334	READ|WRITE	Spare	49	5000	
FL	4	7334	READ|WRITE	Spare	50		
FL	4	7334	READ|WRITE	Spare	51		
FL	4	7334	READ|WRITE	Spare	52		
FL	4	7334	READ|WRITE	Spare	53		
FL	4	7334	READ|WRITE	Spare	54	5020	
FL	4	7334	READ|WRITE	Spare	55		
FL	4	7334	READ|WRITE	Spare	56		
FL	4	7334	READ|WRITE	Spare	57		
FL	4	7334	READ|WRITE	Spare	58		
FL	4	7334	READ|WRITE	Spare	59	5040	

Note: For pulse input meters any reference to DP or 'Primary' should be replaced with Actual Cubic Feet (ACF)

Point Type 6, SP Primary Control PID

Type	*Length*	*Register*	*Attributes*	*Description*	*Parm*	*RAM* *Type* *Length* *Reg* *Attr*	*Meter Type*
AC	10	30316	READ|WRITE	Tag ID	0	25041 5042 5043 5044	
UC	1	3216	READ|WRITE	Reverse Action	1	25045 5046 5047 5048	
UC	1	3219	READ	Switch Status	2		
UI	2	3103	READ|WRITE	Primary Gain	3		
TLP	3	15001	READ|WRITE	Primary Input point	4	5060	
TLP	3	15002	READ|WRITE	Primary Output Point	5		
FL	4	7230	READ|WRITE	Primary High Limit	6		
TLP	3	15003	READ|WRITE	Primary Switch Process Variable	7		
CH	1	3185	READ|WRITE	Not Used	8		
TLP	3	15011	READ|WRITE	Not Used	9	5080	
TLP	3	15011	READ|WRITE	Not Used	10		
FL	4	7225	READ|WRITE	DP Override High Limit	11		

SP Primary Control (cont.)

TLP	3	15011	READ|WRITE	Not Used	12		
CH	1	3099	READ|WRITE	Low Battery Action (0=Close 1=Freeze)	13		
FL	4	7232	READ|WRITE	Primary Setpoint	14	5100	
FL	4	7231	READ|WRITE	Primary Low Limit	15		
UI	2	3217	READ|WRITE	Primary loop period	16		
FL	4	7336	READ|WRITE	Control Type	17		
FL	4	7239	READ|WRITE	Low Battery Limit (volts)	18		
FL	4	7337	READ|WRITE	DP Low Time	19	5120	
FL	4	7342	READ	Status	20		
FL	4	7233	READ|WRITE	Primary Deadband	21		
FL	4	7003	READ	Primary Process Variable	22		
FL	4	7335	READ	Analog Valve Position	23		
FL	4	7339	READ|WRITE	DP Override Gain	24	5140	
UI	2	3220	READ|WRITE	Minimum Control Time	25		
FL	4	7227	READ|WRITE	DP Override Setpoint	26		
FL	4	7226	READ|WRITE	DP Override Low Limit	27		
UI	2	3106	READ|WRITE	Step Time	28		
FL	4	7340	READ|WRITE	DP Shut-In Period	29	5160	
FL	4	7341	READ|WRITE	DP Shut-In Time Remaining	30		
FL	4	7234	READ|WRITE	Pipe Inner Diameter (inches)	31		
FL	4	7229	READ|WRITE	Pipe Length (feet)	32		
FL	4	7228	READ|WRITE	DP Override Deadband	33		
FL	4	7004	READ	Current DP	34	5180	
FL	4	7240	READ|WRITE	SP Override Limit	35		
FL	4	7241	READ|WRITE	SP Restart	36		
FL	4	7003	READ	Current SP	37		
FL	4	7334	READ|WRITE	Spare	38		
FL	4	7334	READ|WRITE	Spare	39	5200	
FL	4	7334	READ|WRITE	Spare	40		
FL	4	7334	READ|WRITE	Spare	41		
FL	4	7334	READ|WRITE	Spare	42		
FL	4	7334	READ|WRITE	Spare	43		
FL	4	7334	READ|WRITE	Spare	44	5220	
FL	4	7334	READ|WRITE	Spare	45		
FL	4	7334	READ|WRITE	Spare	46		
FL	4	7334	READ|WRITE	Spare	47		
FL	4	7334	READ|WRITE	Spare	48		
FL	4	7334	READ|WRITE	Spare	49	5240	
FL	4	7334	READ|WRITE	Spare	50		
FL	4	7334	READ|WRITE	Spare	51		
FL	4	7334	READ|WRITE	Spare	52		
FL	4	7334	READ|WRITE	Spare	53		
FL	4	7334	READ|WRITE	Spare	54	5260	
FL	4	7334	READ|WRITE	Spare	55		
FL	4	7334	READ|WRITE	Spare	56		
FL	4	7334	READ|WRITE	Spare	57		
FL	4	7334	READ|WRITE	Spare	58		
FL	4	7334	READ|WRITE	Spare	59	5280	

Note: For pulse input meters any reference to DP should be replaced with Actual Cubic Feet (ACF)

Point Type 6, Flow Rate Primary Control PID

Type	Length	Register	Attributes	Description	Parm	RAM Type	RAM Length	RAM Reg	RAM Attr	Meter Type
AC	10	30331	READ|WRITE	Tag ID	0	25281	5282	5283	5284	
UC	1	3216	READ|WRITE	Reverse Action	1	25285	5286	5287	5288	
UC	1	3219	READ	Switch Status	2					
UI	2	3104	READ|WRITE	Primary Gain	3					
TLP	3	15001	READ|WRITE	Primary Input point	4				5300	
TLP	3	15002	READ|WRITE	Primary Output Point	5					
FL	4	7235	READ|WRITE	Primary High Limit	6					
TLP	3	15003	READ|WRITE	Primary Switch Process Variable	7					
CH	1	3185	READ|WRITE	Not Used	8					
TLP	3	15011	READ|WRITE	Not Used	9				5320	
TLP	3	15011	READ|WRITE	Not Used	10					
FL	4	7225	READ|WRITE	DP Override High Limit	11					
TLP	3	15011	READ|WRITE	Not Used	12					
CH	1	3099	READ|WRITE	Low Battery Action (0=Close 1=Freeze)	13					
FL	4	7237	READ|WRITE	Primary Setpoint	14				5340	
FL	4	7236	READ|WRITE	Primary Low Limit	15					
UI	2	3217	READ|WRITE	Primary loop period	16					
FL	4	7336	READ|WRITE	Control Type	17					
FL	4	7239	READ|WRITE	Low Battery Limit (volts)	18					
FL	4	7337	READ|WRITE	DP Low Time	19				5360	
FL	4	7342	READ	Status	20					
FL	4	7238	READ|WRITE	Primary Deadband	21					
FL	4	7375	READ	Primary Process Variable	22					
FL	4	7335	READ	Analog Valve Position	23					
FL	4	7339	READ|WRITE	DP Override Gain	24				5380	
UI	2	3220	READ|WRITE	Minimum Control Time	25					
FL	4	7227	READ|WRITE	DP Override Setpoint	26					
FL	4	7226	READ|WRITE	DP Override Low Limit	27					
UI	2	3106	READ|WRITE	Step Time	28					
FL	4	7340	READ|WRITE	DP Shut-In Period	29				5400	
FL	4	7341	READ|WRITE	DP Shut-In Time Remaining	30					
FL	4	7234	READ|WRITE	Pipe Inner Diameter (inches)	31					
FL	4	7229	READ|WRITE	Pipe Length (feet)	32					
FL	4	7228	READ|WRITE	DP Override Deadband	33					
FL	4	7004	READ	Current DP	34				5420	
FL	4	7240	READ|WRITE	SP Override Limit	35					
FL	4	7241	READ|WRITE	SP Restart	36					
FL	4	7003	READ	Current SP	37					
FL	4	7334	READ|WRITE	Spare	38					
FL	4	7334	READ|WRITE	Spare	39				5440	
FL	4	7334	READ|WRITE	Spare	40					
FL	4	7334	READ|WRITE	Spare	41					
FL	4	7334	READ|WRITE	Spare	42					
FL	4	7334	READ|WRITE	Spare	43					
FL	4	7334	READ|WRITE	Spare	44				5460	
FL	4	7334	READ|WRITE	Spare	45					

Flow Rate Primary Control (cont.)

FL	4	7334	READ|WRITE	Spare	46		
FL	4	7334	READ|WRITE	Spare	47		
FL	4	7334	READ|WRITE	Spare	48		
FL	4	7334	READ|WRITE	Spare	49	5480	
FL	4	7334	READ|WRITE	Spare	50		
FL	4	7334	READ|WRITE	Spare	51		
FL	4	7334	READ|WRITE	Spare	52		
FL	4	7334	READ|WRITE	Spare	53		
FL	4	7334	READ|WRITE	Spare	54	5500	
FL	4	7334	READ|WRITE	Spare	55		
FL	4	7334	READ|WRITE	Spare	56		
FL	4	7334	READ|WRITE	Spare	57		
FL	4	7334	READ|WRITE	Spare	58		
FL	4	7334	READ|WRITE	Spare	59	5520	

Note: For pulse input meters any reference to DP should be replaced with Actual Cubic Feet (ACF)

Point Type 7, AGA Flow Parameters

Type	*Length*	*Register*	*Attributes*	*Description*	*Parm*	*RAM* *Type* *Length* *Reg* *Attr*	*Meter Type*
AC	10	30346	READ|WRITE	Tag ID	0	25521 5522 5523 5524	
FL	4	7334	READ	Not Used	1	25525 5526 5527 5528	
FL	4	7334	READ	Not Used	2		
BN	1	3003	READ|WRITE	Calculation Method	3		
BN	1	3187	READ	Not Used	4	5540	
FL	4	7027	READ|WRITE	Specific Gravity	5		
FL	4	7026	READ|WRITE	Heating Value	6		
FL	4	7334	READ	Not Used	7		
UI	2	3186	READ	Not Used	8		
FL	4	7063/7334	READ|WRITE	Pipe Diameter / NULL	9	5560	G.O./P.I.
FL	4	7061/7334	READ|WRITE	Orifice Diameter /NULL	10		G.O./P.I.
FL	4	7334	READ	Not Used	11		
UC	1	1014/3184	READ|WRITE	Orifice Material / NULL	12		G.O./P.I.
AC	30	30361	READ|WRITE	Description	13		
UC	1	3184	READ	Not Used	14	5580	
FL	4	7123	READ|WRITE	Low Alarm EU	15		
FL	4	7124	READ|WRITE	High Alarm EU	16		
FL	4	7054	READ|WRITE	Viscosity	17		
FL	4	7053	READ|WRITE	Specific Heat Ratio	18		
FL	4	7052	READ|WRITE	Contract Pressure	19	5600	
FL	4	7051	READ|WRITE	Contract Temperature	20		
FL	4	7116/7334	READ|WRITE	DP Low Cutoff / NULL	21		G.O./P.I.
FL	4	7334	READ|WRITE	Not Used	22		
FL	4	7029	READ|WRITE	N2 Nitrogen	23		
FL	4	7028	READ|WRITE	CO2 Carbon Dioxide	24	5620	
FL	4	7041	READ|WRITE	H2S Hydrogen Sulfide	25		
FL	4	7048	READ|WRITE	H2O Water	26		
FL	4	7043	READ|WRITE	He Helium	27		
FL	4	7030	READ|WRITE	CH4 Methane	28		
FL	4	7031	READ|WRITE	C2H6 Ethane	29	5640	
FL	4	7032	READ|WRITE	C3H8 Propane	30		

AGA Flow Parameters (cont.)

FL	4	7034	READ|WRITE	C4H10 n-Butane	31		
FL	4	7033	READ|WRITE	C4H10 i-Butane	32		
FL	4	7036	READ|WRITE	C5H12 n-Pentane	33		
FL	4	7035	READ|WRITE	C5H12 i-Pentane	34	5660	
FL	4	7037	READ|WRITE	C6H14 n-Hexane	35		
FL	4	7038	READ|WRITE	C7H16 n-Heptane	36		
FL	4	7039	READ|WRITE	C8H18 n-Octane	37		
FL	4	7040	READ|WRITE	C9H20 n-Nonane	38		
FL	4	7047	READ|WRITE	C10H22 n-Decane	39	5680	
FL	4	7044	READ|WRITE	O2 Oxygen	40		
FL	4	7045	READ|WRITE	CO Carbon Monoxide	41		
FL	4	7042	READ|WRITE	H2 Hydrogen	42		
UC	1	3184	READ	Not Used	43		
UC	1	3184	READ	Not Used	44	5700	
TLP	3	15011	READ|WRITE	Not Used	45		
TLP	3	15011	READ|WRITE	Not Used	46		
TLP	3	15011	READ|WRITE	Not Used	47		
TLP	3	15011	READ|WRITE	Not Used	48		
FL	4	7117/7334	READ|WRITE	Low DP Setpoint / NULL	49	5720	G.O./P.I.
FL	4	7118/7334	READ|WRITE	High DP Setpoint / NULL	50		G.O./P.I.
FL	4	7004/7334	READ	DP / NULL	51		G.O./P.I.
FL	4	7003	READ	SP	52		
FL	4	7005	READ	Tf	53		
FL	4	7334	READ	Spare	54	5740	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	5760	

Point Type 10, AGA Flow Value Parameters

Type	*Length*	*Register*	*Attributes*	*Description*	*Parm*	*RAM* *Type* *Length* *Reg* *Attr*	*Meter Type*
FL	4	7004/7334	READ	DP / NULL	0	25761 5762 5763 5764	G.O./P.I.
FL	4	7003	READ	SP	1	25765 5766 5767 5768	
FL	4	7005	READ	Tf	2		
FL	4	7006	READ	Instantaneous Flow	3		
FL	4	7007	READ	Instantaneous Energy	4	5780	
FL	4	7009	READ	Flow Today	5		
FL	4	7152	READ	Energy Today	6		
FL	4	7022	READ	Flow Yesterday	7		
FL	4	7023	READ	Energy Yesterday	8		
FL	4	7072	READ	Pressure Extension	9	5800	
FL	4	7073	READ	C Prime	10		
FL	4	7334	READ	Not Used	11		
FL	4	7074	READ	Expansion Factor	12		
FL	4	7080	READ	Fr	13		

AGA Flow Value Parameters (cont.)

FL	4	7083	READ	Ftf	14	5820	
FL	4	7075	READ	Fpv	15		
FL	4	7084	READ	Fgr	16		
FL	4	7079	READ	Fb	17		
FL	4	7081	READ	Fpb	18		
FL	4	7082	READ	Ftb	19	5840	
FL	4	7085	READ	Fa	20		
FL	4	7334	READ	Spare	21		
FL	4	7334	READ	Spare	22		
FL	4	7334	READ	Spare	23		
FL	4	7334	READ	Spare	24	5860	
FL	4	7334	READ	Spare	25		
FL	4	7334	READ	Spare	26		
FL	4	7334	READ	Spare	27		
FL	4	7334	READ	Spare	28		
FL	4	7334	READ	Spare	29	5880	
FL	4	7334	READ	Spare	30		
FL	4	7334	READ	Spare	31		
FL	4	7334	READ	Spare	32		
FL	4	7334	READ	Spare	33		
FL	4	7334	READ	Spare	34	5900	
FL	4	7334	READ	Spare	35		
FL	4	7334	READ	Spare	36		
FL	4	7334	READ	Spare	37		
FL	4	7334	READ	Spare	38		
FL	4	7334	READ	Spare	39	5920	
FL	4	7334	READ	Spare	40		
FL	4	7334	READ	Spare	41		
FL	4	7334	READ	Spare	42		
FL	4	7334	READ	Spare	43		
FL	4	7334	READ	Spare	44	5940	
FL	4	7334	READ	Spare	45		
FL	4	7334	READ	Spare	46		
FL	4	7334	READ	Spare	47		
FL	4	7334	READ	Spare	48		
FL	4	7334	READ	Spare	49	5960	
FL	4	7334	READ	Spare	50		
FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	5980	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	6000	

Point Type 12, Clock Parameters

Type	Length	Register	Attributes	Description	Parm	RAM Type	RAM Length	RAM Reg	RAM Attr	Meter Type
UC	1	3200	READ|WRITE	seconds	0	26001	6002	6003	6004	
UC	1	3199	READ|WRITE	minutes	1	26005	6006	6007	6008	
UC	1	3198	READ|WRITE	hours	2					
UC	1	3196	READ|WRITE	day	3					
UC	1	3195	READ|WRITE	month	4				6020	
UC	1	3197	READ|WRITE	year	5					
UC	1	3184	READ|WRITE	Not Used	6					
UC	1	3201	READ|WRITE	day of week	7					
TM	6	3202	READ|WRITE	Time info	8					
FL	4	7334	READ	Spare	9				6040	
FL	4	7334	READ	Spare	10					
FL	4	7334	READ	Spare	11					
FL	4	7334	READ	Spare	12					
FL	4	7334	READ	Spare	13					
FL	4	7334	READ	Spare	14				6060	
FL	4	7334	READ	Spare	15					
FL	4	7334	READ	Spare	16					
FL	4	7334	READ	Spare	17					
FL	4	7334	READ	Spare	18					
FL	4	7334	READ	Spare	19				6080	
FL	4	7334	READ	Spare	20					
FL	4	7334	READ	Spare	21					
FL	4	7334	READ	Spare	22					
FL	4	7334	READ	Spare	23					
FL	4	7334	READ	Spare	24				6100	
FL	4	7334	READ	Spare	25					
FL	4	7334	READ	Spare	26					
FL	4	7334	READ	Spare	27					
FL	4	7334	READ	Spare	28					
FL	4	7334	READ	Spare	29				6120	
FL	4	7334	READ	Spare	30					
FL	4	7334	READ	Spare	31					
FL	4	7334	READ	Spare	32					
FL	4	7334	READ	Spare	33					
FL	4	7334	READ	Spare	34				6140	
FL	4	7334	READ	Spare	35					
FL	4	7334	READ	Spare	36					
FL	4	7334	READ	Spare	37					
FL	4	7334	READ	Spare	38					
FL	4	7334	READ	Spare	39				6160	
FL	4	7334	READ	Spare	40					
FL	4	7334	READ	Spare	41					
FL	4	7334	READ	Spare	42					
FL	4	7334	READ	Spare	43					
FL	4	7334	READ	Spare	44				6180	
FL	4	7334	READ	Spare	45					
FL	4	7334	READ	Spare	46					
FL	4	7334	READ	Spare	47					
FL	4	7334	READ	Spare	48					
FL	4	7334	READ	Spare	49				6200	
FL	4	7334	READ	Spare	50					

Clock Parameters (cont.)

FL	4	7334	READ	Spare	51		
FL	4	7334	READ	Spare	52		
FL	4	7334	READ	Spare	53		
FL	4	7334	READ	Spare	54	6220	
FL	4	7334	READ	Spare	55		
FL	4	7334	READ	Spare	56		
FL	4	7334	READ	Spare	57		
FL	4	7334	READ	Spare	58		
FL	4	7334	READ	Spare	59	6240	

Point Type 14, Remote Port

Type	Length	Register	Attributes	Description	Parm	RAM Type	RAM Length	RAM Reg	RAM Attr	Meter Type
AC	10	30376	READ|WRITE	Tag id	0	26241	6242	6243	6244	
UI	2	3012	READ|WRITE	Baud	1	26245	6246	6247	6248	
UC	1	3015	READ|WRITE	Stop Bits	2					
UC	1	3013	READ|WRITE	Data Bits	3					
UC	1	3014	READ|WRITE	Parity	4				6260	
BN	1	3187	READ	Not Used	5					
BN	1	3187	READ|WRITE	Not Used	6					
UC	1	3017	READ|WRITE	Key on Delay	7					
UC	1	3018	READ|WRITE	Turnaround Delay	8					
UC	1	3019	READ|WRITE	Protocol	9				6280	
UI	2	3072	READ|WRITE	Timeout (RTO)	10					
UI	2	3186	READ	Not Used	11					
UI	2	3186	READ	Not Used	12					
UI	2	3186	READ	Not Used	13					
UI	2	3186	READ|WRITE	Not Used	14				6300	
FL	4	7334	READ|WRITE	Spare	15					
FL	4	7334	READ|WRITE	Spare	16					
FL	4	7334	READ|WRITE	Spare	17					
FL	4	7334	READ|WRITE	Spare	18					
FL	4	7334	READ|WRITE	Spare	19				6320	
FL	4	7334	READ|WRITE	Spare	20					
FL	4	7334	READ|WRITE	Spare	21					
FL	4	7334	READ|WRITE	Spare	22					
FL	4	7334	READ|WRITE	Spare	23					
FL	4	7334	READ|WRITE	Spare	24				6340	
FL	4	7334	READ|WRITE	Spare	25					
FL	4	7334	READ|WRITE	Spare	26					
FL	4	7334	READ|WRITE	Spare	27					
FL	4	7334	READ|WRITE	Spare	28					
FL	4	7334	READ|WRITE	Spare	29				6360	
FL	4	7334	READ|WRITE	Spare	30					
FL	4	7334	READ|WRITE	Spare	31					
FL	4	7334	READ|WRITE	Spare	32					

Remote Port (cont.)

FL	4	7334	READ|WRITE	Spare	33		
FL	4	7334	READ|WRITE	Spare	34	6380	
FL	4	7334	READ|WRITE	Spare	35		
FL	4	7334	READ|WRITE	Spare	36		
FL	4	7334	READ|WRITE	Spare	37		
FL	4	7334	READ|WRITE	Spare	38		
FL	4	7334	READ|WRITE	Spare	39	6400	
FL	4	7334	READ|WRITE	Spare	40		
FL	4	7334	READ|WRITE	Spare	41		
FL	4	7334	READ|WRITE	Spare	42		
FL	4	7334	READ|WRITE	Spare	43		
FL	4	7334	READ|WRITE	Spare	44	6420	
FL	4	7334	READ|WRITE	Spare	45		
FL	4	7334	READ|WRITE	Spare	46		
FL	4	7334	READ|WRITE	Spare	47		
FL	4	7334	READ|WRITE	Spare	48		
FL	4	7334	READ|WRITE	Spare	49	6440	
FL	4	7334	READ|WRITE	Spare	50		
FL	4	7334	READ|WRITE	Spare	51		
FL	4	7334	READ|WRITE	Spare	52		
FL	4	7334	READ|WRITE	Spare	53		
FL	4	7334	READ|WRITE	Spare	54	6460	
FL	4	7334	READ|WRITE	Spare	55		
FL	4	7334	READ|WRITE	Spare	56		
FL	4	7334	READ|WRITE	Spare	57		
FL	4	7334	READ|WRITE	Spare	58		
FL	4	7334	READ|WRITE	Spare	59	6480	

Point Type 14, AUX Port

Type	Length	Register	Attributes	Description	Parm	RAM Type	Length	Reg	Attr	Meter Type
AC	10	30391	READ|WRITE	Tag id	0	26481	6482	6483	6484	
UI	2	3163	READ|WRITE	Baud	1	26485	6486	6487	6488	
UC	1	3166	READ|WRITE	Stop Bits	2					
UC	1	3164	READ|WRITE	Data Bits	3					
UC	1	3165	READ|WRITE	Parity	4				6500	
BN	1	3187	READ	Not Used	5					
BN	1	3187	READ|WRITE	Not Used	6					
UC	1	3168	READ|WRITE	Key on Delay	7					
UC	1	3169	READ|WRITE	Turnaround Delay	8					
UC	1	3170	READ|WRITE	Protocol	9				6520	
UI	2	3074	READ|WRITE	Timeout (ATO)	10					
UI	2	3186	READ	Not Used	11					
UI	2	3186	READ	Not Used	12					
UI	2	3186	READ	Not Used	13					
UI	2	3186	READ|WRITE	Not Used	14				6540	

AUX Port (cont.)

FL	4	7334	READ|WRITE	Spare	15		
FL	4	7334	READ|WRITE	Spare	16		
FL	4	7334	READ|WRITE	Spare	17		
FL	4	7334	READ|WRITE	Spare	18		
FL	4	7334	READ|WRITE	Spare	19	6560	
FL	4	7334	READ|WRITE	Spare	20		
FL	4	7334	READ|WRITE	Spare	21		
FL	4	7334	READ|WRITE	Spare	22		
FL	4	7334	READ|WRITE	Spare	23		
FL	4	7334	READ|WRITE	Spare	24	6580	
FL	4	7334	READ|WRITE	Spare	25		
FL	4	7334	READ|WRITE	Spare	26		
FL	4	7334	READ|WRITE	Spare	27		
FL	4	7334	READ|WRITE	Spare	28		
FL	4	7334	READ|WRITE	Spare	29	6600	
FL	4	7334	READ|WRITE	Spare	30		
FL	4	7334	READ|WRITE	Spare	31		
FL	4	7334	READ|WRITE	Spare	32		
FL	4	7334	READ|WRITE	Spare	33		
FL	4	7334	READ|WRITE	Spare	34	6620	
FL	4	7334	READ|WRITE	Spare	35		
FL	4	7334	READ|WRITE	Spare	36		
FL	4	7334	READ|WRITE	Spare	37		
FL	4	7334	READ|WRITE	Spare	38		
FL	4	7334	READ|WRITE	Spare	39	6640	
FL	4	7334	READ|WRITE	Spare	40		
FL	4	7334	READ|WRITE	Spare	41		
FL	4	7334	READ|WRITE	Spare	42		
FL	4	7334	READ|WRITE	Spare	43		
FL	4	7334	READ|WRITE	Spare	44	6660	
FL	4	7334	READ|WRITE	Spare	45		
FL	4	7334	READ|WRITE	Spare	46		
FL	4	7334	READ|WRITE	Spare	47		
FL	4	7334	READ|WRITE	Spare	48		
FL	4	7334	READ|WRITE	Spare	49	6680	
FL	4	7334	READ|WRITE	Spare	50		
FL	4	7334	READ|WRITE	Spare	51		
FL	4	7334	READ|WRITE	Spare	52		
FL	4	7334	READ|WRITE	Spare	53		
FL	4	7334	READ|WRITE	Spare	54	6700	
FL	4	7334	READ|WRITE	Spare	55		
FL	4	7334	READ|WRITE	Spare	56		
FL	4	7334	READ|WRITE	Spare	57		
FL	4	7334	READ|WRITE	Spare	58		
FL	4	7334	READ|WRITE	Spare	59	6720	

Point Type 14, AUXB Port

Type	Length	Register	Attributes	Description	Parm	RAM Type	RAM Length	RAM Reg	RAM Attr	Meter Type
AC	10	30406	READ|WRITE	Tag id	0	26721	6722	6723	6724	
UI	2	3172	READ|WRITE	Baud	1	26725	6726	6727	6728	
UC	1	3175	READ|WRITE	Stop Bits	2					
UC	1	3173	READ|WRITE	Data Bits	3					
UC	1	3174	READ|WRITE	Parity	4				6740	
BN	1	3187	READ	Not Used	5					
BN	1	3187	READ|WRITE	Not Used	6					
UC	1	3177	READ|WRITE	Key on Delay	7					
UC	1	3178	READ|WRITE	Turnaround Delay	8					
UC	1	3179	READ|WRITE	Protocol	9				6760	
UI	2	3233	READ|WRITE	Timeout (BTO)	10					
UI	2	3186	READ	Not Used	11					
UI	2	3186	READ	Not Used	12					
UI	2	3186	READ	Not Used	13					
UI	2	3186	READ|WRITE	Not Used	14				6780	
FL	4	7334	READ|WRITE	Spare	15					
FL	4	7334	READ|WRITE	Spare	16					
FL	4	7334	READ|WRITE	Spare	17					
FL	4	7334	READ|WRITE	Spare	18					
FL	4	7334	READ|WRITE	Spare	19				6800	
FL	4	7334	READ|WRITE	Spare	20					
FL	4	7334	READ|WRITE	Spare	21					
FL	4	7334	READ|WRITE	Spare	22					
FL	4	7334	READ|WRITE	Spare	23					
FL	4	7334	READ|WRITE	Spare	24				6820	
FL	4	7334	READ|WRITE	Spare	25					
FL	4	7334	READ|WRITE	Spare	26					
FL	4	7334	READ|WRITE	Spare	27					
FL	4	7334	READ|WRITE	Spare	28					
FL	4	7334	READ|WRITE	Spare	29				6840	
FL	4	7334	READ|WRITE	Spare	30					
FL	4	7334	READ|WRITE	Spare	31					
FL	4	7334	READ|WRITE	Spare	32					
FL	4	7334	READ|WRITE	Spare	33					
FL	4	7334	READ|WRITE	Spare	34				6860	
FL	4	7334	READ|WRITE	Spare	35					
FL	4	7334	READ|WRITE	Spare	36					
FL	4	7334	READ|WRITE	Spare	37					
FL	4	7334	READ|WRITE	Spare	38					
FL	4	7334	READ|WRITE	Spare	39				6880	
FL	4	7334	READ|WRITE	Spare	40					
FL	4	7334	READ|WRITE	Spare	41					
FL	4	7334	READ|WRITE	Spare	42					
FL	4	7334	READ|WRITE	Spare	43					
FL	4	7334	READ|WRITE	Spare	44				6900	
FL	4	7334	READ|WRITE	Spare	45					
FL	4	7334	READ|WRITE	Spare	46					
FL	4	7334	READ|WRITE	Spare	47					
FL	4	7334	READ|WRITE	Spare	48					

AUXB Port (cont.)

FL	4	7334	READ|WRITE	Spare	49	6920	
FL	4	7334	READ|WRITE	Spare	50		
FL	4	7334	READ|WRITE	Spare	51		
FL	4	7334	READ|WRITE	Spare	52		
FL	4	7334	READ|WRITE	Spare	53		
FL	4	7334	READ|WRITE	Spare	54	6940	
FL	4	7334	READ|WRITE	Spare	55		
FL	4	7334	READ|WRITE	Spare	56		
FL	4	7334	READ|WRITE	Spare	57		
FL	4	7334	READ|WRITE	Spare	58		
FL	4	7334	READ|WRITE	Spare	59	6960	

Point Type 15, System Variables

Type	Length	Register	Attributes	Description	Parm	RAM Type	RAM Length	RAM Reg	RAM Attr	Meter Type
UC	1	3011	READ|WRITE	Address	0	26961	6962	6963	6964	
UC	1	3070	READ|WRITE	Group	1	26965	6966	6967	6968	
AC	20	30421	READ|WRITE	Station Name	2					
UC	1	3184	READ	Not Used	3					
UC	1	3184	READ	Not Used	4				6980	
UC	1	3184	READ	Not Used	5					
UC	1	3184	READ	Not Used	6					
UC	1	3184	READ	Not Used	7					
UC	1	3184	READ	Not Used	8					
UC	1	3184	READ	Not Used	9				7000	
UC	1	3009	READ|WRITE	Contract Hour	10					
AC	20	30436	READ|WRITE	Part Number	11					
AC	20	30451	READ|WRITE	ID	12					
AC	20	30466	READ|WRITE	Time Created	13					
AC	12	30481	READ|WRITE	Serial Number	14				7020	
AC	20	30496	READ|WRITE	Customer Name	15					
UC	1	3184	READ	Not Used	16					
UC	1	3184	READ	Not Used	17					
UC	1	3184	READ	Not Used	18					
UC	1	3184	READ	Not Used	19				7040	
UC	1	3184	READ	Not Used	20					
UC	1	3184	READ	Not Used	21					
FL	4	7334	READ	Not Used	22					
UC	1	3184	READ	Not Used	23					
FL	4	7334	READ|WRITE	Spare	24				7060	
FL	4	7334	READ|WRITE	Spare	25					
FL	4	7334	READ|WRITE	Spare	26					
FL	4	7334	READ|WRITE	Spare	27					
FL	4	7334	READ|WRITE	Spare	28					
FL	4	7334	READ|WRITE	Spare	29				7080	
FL	4	7334	READ|WRITE	Spare	30					
FL	4	7334	READ|WRITE	Spare	31					

System Variables (cont.)

FL	4	7334	READ|WRITE	Spare	32		
FL	4	7334	READ|WRITE	Spare	33		
FL	4	7334	READ|WRITE	Spare	34	7100	
FL	4	7334	READ|WRITE	Spare	35		
FL	4	7334	READ|WRITE	Spare	36		
FL	4	7334	READ|WRITE	Spare	37		
FL	4	7334	READ|WRITE	Spare	38		
FL	4	7334	READ|WRITE	Spare	39	7120	
FL	4	7334	READ|WRITE	Spare	40		
FL	4	7334	READ|WRITE	Spare	41		
FL	4	7334	READ|WRITE	Spare	42		
FL	4	7334	READ|WRITE	Spare	43		
FL	4	7334	READ|WRITE	Spare	44	7140	
FL	4	7334	READ|WRITE	Spare	45		
FL	4	7334	READ|WRITE	Spare	46		
FL	4	7334	READ|WRITE	Spare	47		
FL	4	7334	READ|WRITE	Spare	48		
FL	4	7334	READ|WRITE	Spare	49	7160	
FL	4	7334	READ|WRITE	Spare	50		
FL	4	7334	READ|WRITE	Spare	51		
FL	4	7334	READ|WRITE	Spare	52		
FL	4	7334	READ|WRITE	Spare	53		
FL	4	7334	READ|WRITE	Spare	54	7180	
FL	4	7334	READ|WRITE	Spare	55		
FL	4	7334	READ|WRITE	Spare	56		
FL	4	7334	READ|WRITE	Spare	57		
FL	4	7334	READ|WRITE	Spare	58		
FL	4	7334	READ|WRITE	Spare	59	7200	

Point Type 34, Modbus User Configuration

Type	*Length*	*Register*	*Attributes*	*Description*	*Parm*	*RAM* *Type* *Length* *Reg* *Attr*	*Meter Type*
CH	1	3215	READ	Host Type ASCII/RTU	0	27201 7202 7203 7204	
UC	1	3184	READ|WRITE	Not Used	1	27205 7206 7207 7208	
UC	1	3184	READ|WRITE	Not Used	2		
UC	1	3184	READ|WRITE	Not Used	3		
UC	1	3184	READ	Not Used	4	7220	
UC	1	3184	READ|WRITE	Not Used	5		
UC	1	3184	READ|WRITE	Not Used	6		
UI	2	3186	READ|WRITE	Not Used	7		
UI	2	3186	READ|WRITE	Not Used	8		
UI	2	3186	READ|WRITE	Not Used	9	7240	
UI	2	3186	READ|WRITE	Not Used	10		
FL	4	7334	READ|WRITE	Spare	11		
FL	4	7334	READ|WRITE	Spare	12		
FL	4	7334	READ|WRITE	Spare	13		
FL	4	7334	READ|WRITE	Spare	14	7260	
FL	4	7334	READ|WRITE	Spare	15		

User Configuration (cont.)

FL	4	7334	READ|WRITE	Spare	16		
FL	4	7334	READ|WRITE	Spare	17		
FL	4	7334	READ|WRITE	Spare	18		
FL	4	7334	READ|WRITE	Spare	19	7280	
FL	4	7334	READ|WRITE	Spare	20		
FL	4	7334	READ|WRITE	Spare	21		
FL	4	7334	READ|WRITE	Spare	22		
FL	4	7334	READ|WRITE	Spare	23		
FL	4	7334	READ|WRITE	Spare	24	7300	
FL	4	7334	READ|WRITE	Spare	25		
FL	4	7334	READ|WRITE	Spare	26		
FL	4	7334	READ|WRITE	Spare	27		
FL	4	7334	READ|WRITE	Spare	28		
FL	4	7334	READ|WRITE	Spare	29	7320	
FL	4	7334	READ|WRITE	Spare	30		
FL	4	7334	READ|WRITE	Spare	31		
FL	4	7334	READ|WRITE	Spare	32		
FL	4	7334	READ|WRITE	Spare	33		
FL	4	7334	READ|WRITE	Spare	34	7340	
FL	4	7334	READ|WRITE	Spare	35		
FL	4	7334	READ|WRITE	Spare	36		
FL	4	7334	READ|WRITE	Spare	37		
FL	4	7334	READ|WRITE	Spare	38		
FL	4	7334	READ|WRITE	Spare	39	7360	
FL	4	7334	READ|WRITE	Spare	40		
FL	4	7334	READ|WRITE	Spare	41		
FL	4	7334	READ|WRITE	Spare	42		
FL	4	7334	READ|WRITE	Spare	43		
FL	4	7334	READ|WRITE	Spare	44	7380	
FL	4	7334	READ|WRITE	Spare	45		
FL	4	7334	READ|WRITE	Spare	46		
FL	4	7334	READ|WRITE	Spare	47		
FL	4	7334	READ|WRITE	Spare	48		
FL	4	7334	READ|WRITE	Spare	49	7400	
FL	4	7334	READ|WRITE	Spare	50		
FL	4	7334	READ|WRITE	Spare	51		
FL	4	7334	READ|WRITE	Spare	52		
FL	4	7334	READ|WRITE	Spare	53		
FL	4	7334	READ|WRITE	Spare	54	7420	
FL	4	7334	READ|WRITE	Spare	55		
FL	4	7334	READ|WRITE	Spare	56		
FL	4	7334	READ|WRITE	Spare	57		
FL	4	7334	READ|WRITE	Spare	58		
FL	4	7334	READ|WRITE	Spare	59	7440	

XXIII. Baud Rates

Supported baud rates range from 300 to 38,400. These may be set through local terminal mode using the appropriate command, or they may be set through Point Type 14 parameter 1 ' Baud Rate'. The following table shows the correlation between the input value and the corresponding baud rate.

Baud Rate	*Input Value*
300	10
600	11
1200	0
2400	1
4800	2
9600	3
19200	4
38400	5

Important:

When operating at 300 and 600 baud, the character timeout value becomes critical to proper communications between the flow computer and host. At 300 baud this value should be at least 500 and may be set locally or through the communications Point Type. For example to run the Remote Port at 300 baud, "RTO = 500" entered locally will allow this port to have reliable communications. When running at 600 baud, a character timeout value greater than 250 is acceptable. Values less than those recommended will result in the flow computer answering a poll only when the poll happens to align properly with the internal timing routine of the FCU. (At 600 baud and RTO=100 successful communications occur at about 70%.)

XXIV. Analog Inputs

There are two analog inputs available for use and are located at J13. While these inputs may be calibrated through a procedure using local commands, the preferred method is accomplished using PCCU32 with a local connection since it is much simpler and less time consuming. Calibration and setup procedures are discussed through online help within PCCU32. Once setup is complete the settings will be displayed through Point Type 3. Following is a description of some of the relevant parameters for this Point Type:

Units – character string entered by the user to describe what type of units were chosen for the 'Calibration Range' in PCCU32

Current AI Value – value associated with the Units parameter

Current AI Volts – the actual voltage being input to that analog

Further information on calibrating the analog inputs is provided in the section titled Basic Configuration.

XXV. Analog Outputs

Using the Quad AO board (part 2012911), 4 analog outputs are available. These may calibrated with PCCU32 through a local connection. For any analog output which is not designated for use as the valve control AO, several modes may be chosen to control the AO. These modes may be setup at the time of calibration through PCCU32 or set/changed through the analog output Point Type 4 parameter #7 'Mode'. The following table shows the modes and their corresponding value to activate.

Mode	*Value*
Manual	0
Proportional to Temp	1
Proportional to Static Press	2
Proportional to Diff Press	4
Proportional to Flow Rate	8

Only one mode may be active at a time for each analog output. Selecting Manual Mode in effect turns off tracking for that AO. If a mode is selected for the AO being used for valve control, the command is simply ignored and that AO will continue with valve control.

Following are some of the parameters for the analog outputs and a short description:

Low Cal Point – shows what the low calibration point is for this AO.

High Cal Point – shows the high calibration point.

Low Reading EU – if this AO has been selected to be proportional to a process variable, displays the Low Value set in PCCU32 to correspond with the Low Cal Point.

High Reading EU – displays High Value set to correspond with the High Cal Point.

Value in EUs – displays the current value of the process variable this AO is tracking.

Further information on calibrating the analog outputs is given in the section titled Basic Configuration.

XXVI. Analog Valve Control

This section is intended to describe the operation, terminology, and use of the Totalflow implementation of analog valve control logic for PG&E. First, a general overview of the basic operation of the process will be presented followed by more detailed information on each of the components and parameters involved in the control logic.

Overview:

The analog valve control feature provides automatic feedback control of three process variables – Differential Pressure (DP), Static Pressure (SP), and Flow Rate (FR). This control serves the purpose of positioning a flow valve to maintain a desired value of DP, SP, or FR.

A controller is a device which regulates or controls its output based on inputs received. With the Totalflow valve control system, the controller is a microprocessor which is mounted on the flow computer's (FCU's) interface board. The output of the controller is a time period, and in the case of analog valve control, this period is then converted to a percentage. This percentage corresponds to level of current between 4mA and 20mA which is then output to the actuator through one of the available analog output channels. The inputs to the controller are normally the DP and SP values measured by the flow computer. The exception to this is that the SP may be provided by an analog input when the valve location is downstream from the flow computer. The flow computer uses these values to calculate the flow rate. Each of these is selectable as the process variable to be controlled by the action of the valve. The output from the controller and resulting valve movement are such that the process variable is maintained at the user defined level.

All pertinent control data is kept in the FCU's memory. This allows the data to be backed up with the FCU's board mounted lithium battery. When controller data is modified by the user (e.g. GAIN, LIMITS, etc.) the data is stored in the FCU's memory. The FCU measures the variables and stores them in its RAM. All the data is available to the controller whenever required. A special communications link between the FCU and the interface board where the controller is located allows for rapid transfer of the data. The controller transfers data to the FCU's memory whenever it finishes a control action. The updated status information in the FCU's memory is made available to both the PCCU and the CCU.

The controller's algorithm and data conversion programs take approximately ten seconds to execute. Therefore, assuming no valve movement is required, the controller requests data from the FCU and executes the control algorithm once every ten seconds. In the event a valve movement is required, the controller waits for the valve movement to finish before requesting new data from the FCU. The minimum controller output period is set to 80 milliseconds. The maximum output period possible is the time to ramp a valve from full open to full closed or vice versa. The maximum output for normal control is determined by the value entered for the Gain. This can be seen within the valve control algorithm presented later in this section.

Terminology:

The following is a list of terms and definitions used in configuring the Totalflow analog valve controller. Italicized entries are taken directly from the PCCU32 program interface, and so additional online help is available. Non-italicized entries are general definitions.

Process Variable – Parameter being controlled: DP, SP, FR.

Hi Limit – The process variable's upper limit for control. The highest value at which the process variable can be controlled. Has the same engineering units as the process variable.

Lo Limit – The process variable's lower limit for control. The lowest value at which the process variable can be controlled. Has the same units as the process variable.

Control Mode -- Specifies whether a controller is turned off or on for automatic control operation. There are four modes of operation:

1) None: Controller is turned off, no control action results.
2) DP: Controller is turned on, automatic feedback control action is in progress controlling on the DP Set Point.
3) AP: Controller is turned on, automatic feedback control action is in progress controlling on the AP Set Point.
4) Flow Rate: Controller is turned on, automatic feedback control action is in progress controlling on the Flow Rate Set Point.

Set Point -- The value at which the controller will try to maintain the process variable. Set point has the same units as the process variable.

Dead Band -- Specifies a range around the process variable's Set Point within which the controller will take no action. Dead Band has the same engineering units as the process variable.

Example: If the Set Point is 50 and the Dead Band is 5, the controller will take no action when the Process Variable is between 45 and 55. A proper Dead Band is important for maintaining the integrity of the systems battery capacity.

Gain -- The maximum allowable CONTROLLER OUTPUT for any one control action. A good rule of thumb is to use 1/2 the control valve's travel time from a full open to a full closed state. GAIN has engineering units of milliseconds.

Ctl Output (mSecs) -- The output of the control algorithm or equation. The output is a time period for either opening or closing the valve. In the case of analog valve control, the FCU converts this time to a percentage based on a 4mA to 20mA range. Ctl Output has engineering units of milliseconds.

SP Override – There are three selections for this parameter:

1) Disable – do not use SP Override.
2) High – SP Override when current SP goes above SP Override Limit.
3) Low – SP Override when current SP goes below SP Override Limit.

SP Override Limit (PSIA) – Limit used to determine if an SP Override condition exists.

SP Restart (PSIA) -- value determines what pressure to restart previous controller after shut-in. SP restart will only be used by the controller when 1) SI (Shut-in) is set in controller and 2) SP override value has been reached and valve has been closed by SP controller.

Low BV Valve Action – If the battery voltage falls below the limit set in BV Low Limit (Volts), the valve can either fail closed or freeze at its' current location.

BV Low Limit (Volts) – A low voltage threshold used by the controller's logic to detect a low battery condition. The default value is 11.5VDC.

DP Low Time -- A duration, in minutes, used by the controller logic to determine if a DP Shut –in condition exists. If the DP is below its' Lo Limit for the specified time, the DP Shut-in condition exists and the valve is ramped closed. The controller checks for this condition when in the Shut-in Override mode has been selected. The default value is 0 minutes. The range is 65535 minutes.

DP Shut-in -- The selection of the method to generate a restart command if the controller is in a Fail Closed shut-in condition. Selection of Normal allows a timer DP Shut-in Period to be used to restart the controller. Selection of React on AP HI allows the restart command to occur when the SP reaches its Hi Limit, timer or external event.

DP Shut-in Period -- The timer setting used with the DP LOW SHUT IN mode. Can be set from 0-255 minutes or hours .

Shut-in Timer Unit – Sets DP shut-in period units to hours or minutes(default).

Shut-in left (mins) -- Once the timer is activated by a DP Low Shut-in condition, the display will show the time remaining on the timer before the restart command is issued.

Step Time -- A period, in milliseconds, used when a Step Open or Step Closed command is processed. This period is also used when a valve is initially opened from a full closed position. The default is 0. The range is 65535 milliseconds.

Step Open/ Closed -- These commands will move the control valve in the desired direction for the specified Step Time period. Only one Valve Step is made for each Step Command.

Ramp open/Closed -- These commands will move the control valve continuously in the desired direction until the control valve trips the respective open or closed limit switch.

Valve Location -- The UpStream or DownStream location of the valve with respect to the flow computer.

Pipe ID -- The internal diameter, in inches, of the pipe run between the well head and the metering point.

Pipe Length -- The distance, in feet, between the well head and the metering point.

Valve Control Algorithm:

Error – The difference between the current value of the Process Variable and its' Set Point.

Span – Hi Limit value minus Low Limit value. The process Variables range of control. Span has the same engineering units as the Process Variable.

Direction -- Specifies whether the valve needs to be closed or opened to achieve the desired Set Point.

The system has three controllers, only one of which can be active at any given time. The control equation is best described as a "Single Speed Floating Algorithm". This algorithm provides integral action based on:

The process variable's difference from set point (ERROR)
The process variable's range of control (SPAN)
The total possible valve travel time (GAIN)

The Control algorithm is as follows:

ERROR = PROCESS VARIABLE - SET POINT

If ERROR is greater than the DEAD BAND then:

CONTROLLER OUTPUT = (ERROR / SPAN) * GAIN

If ERROR is less than or equal to the DEAD BAND then:

CONTROLLER OUTPUT = 0

DIRECTION of valve movement:

AP MODE	If AP is less than the AP SET POINT, close valve.
FLOW MODE	If FLOW is less than the FLOW SET POINT, open valve.
DP MODE	If DP is less than the DP SET POINT, open valve.

The output and direction computed above are for control valve location downstream from the metering point. See definition of DIRECTION.

SP Well Head Calculation:

SP BIAS -- The term used to describe the pressure drop between the well head and the metering point. The well head pressure can then be determined for use by the SP controller. The WELL HEAD PRESSURE = SP at METER + SP_BIAS.

Note: If using upstream control valve, an external pressure can be installed upstream of control valve for the process variable. (Well head Pressure)

The Weymouth formula is used to determine the SP_BIAS.

$$\text{SP\_BIAS} = \left[L \times \left[\frac{Q_s}{871 \times d^{2.667}} \right]^2 + P_2^2 \right]^{1/2} - P_2$$

which was derived from:

$$Q_s = 871 \times d^{2.667} \times \left[\frac{P_1^2 - P_2^2}{L} \right]^{1/2}$$

where:

Q_s	=	rate of gas flow, cu ft/24 hr.	(calculated by FCU)
d	=	internal diameter of pipe, in.	
P_1	=	initial pressure, PSIA.	(pressure at well head)
P_2	=	terminal pressure, PSIA.	(pressure measured by FCU)
L	=	length of line in miles.	

Valve Control Operation Basics:

A flow chart follows this discussion to provide a more graphical representation of the processes covered here.

Once a process variable has been selected for use, the controller will work to maintain this variable at the specified set point with no more deviation than allowed for by the dead band. The status of this relationship is checked by a period set with the parameter Primary Loop Delay, whose value for analog valve control has a default of 3000mSec. At this time, if the process variable is outside of the specified dead band, a controller output value for valve movement (valve travel) and the direction are calculated based on the difference between the two variables. However, these values are not acted upon until further analysis has been done by the valve control logic. There are five conditions which could preclude using the values calculated for the action required by the process variable. These are:

1) If SP override is enabled and the process variable has held control for the minimum control time, the FCU will calculate what valve movement would cause an SP override condition to exist. If the SP override type selected is High and the current SP is greater than this value, the following logic will occur:

A) If the direction calculated by the process variable logic is to close the valve, the FCU will use whichever is higher (process variable valve travel vs. SP override valve travel).
B) If the direction calculated by the process variable logic is to open the valve, the FCU will override and close the valve with the value calculated for the SP override valve travel.

SP Override will now control for the minimum control time before any other conditions are analyzed.

2) If SP override is enabled and the process variable has held control for the minimum control time, the FCU will calculate what valve movement would cause an SP override condition to exist. If the SP override type selected is Low and the current SP is less than this value, the following logic will occur:

A) If the direction calculated by the process variable logic is to close the valve, the FCU will use whichever is higher (process variable valve travel vs. SP override valve travel).

B) If the direction calculated by the process variable logic is to open the valve, the FCU will override and close the valve with the value calculated for the SP override valve travel.

SP Override will now control for the minimum control time before any other conditions are analyzed.

3) If SP override is not enabled or is enabled but did not override and the process variable has maintained control for the minimum control time, and the current DP value is greater than the DP high limit, the FCU will calculate what valve movement would cause a DP override condition. The following logic will then occur:

A) If the direction calculated by the process variable logic is to close the valve, the FCU will use whichever is higher (process variable valve travel vs. DP override valve travel).

B) If the direction calculated by the process variable logic is to open the valve, the FCU will override and close the valve with the value calculated for the DP override valve travel.

DP high override will now control for the minimum control time before any other conditions are analyzed.

4) If SP override is not enabled or is enabled but did not override and the process variable has maintained control for the minimum control time, and the current DP value is less than the DP low limit, the FCU will calculate what valve movement would cause a DP override condition. The following logic will then occur if the DP low limit is not set to zero:

A) If the direction calculated by the process variable logic is to open the valve, the FCU will use whichever is higher (process variable valve travel vs. DP override valve travel).

B) If the direction calculated by the process variable logic is to close the valve, the FCU will override and open the valve with the value calculated for the DP override valve travel.

DP low override will now control for the minimum control time before any other conditions are analyzed.

5) Whether or not the minimum control time has been met by the process variable, valve travel will be calculated by the FCU for DP to determine if the requested travel would cause a DP high or DP low override condition to occur. The following DP logic will then occur:

   A) If the process variables calculated direction is to open the valve but its' valve travel is greater than that calculated for DP, a DP override high is asserted and the valve will open only as far as the distance calculated for the DP travel.

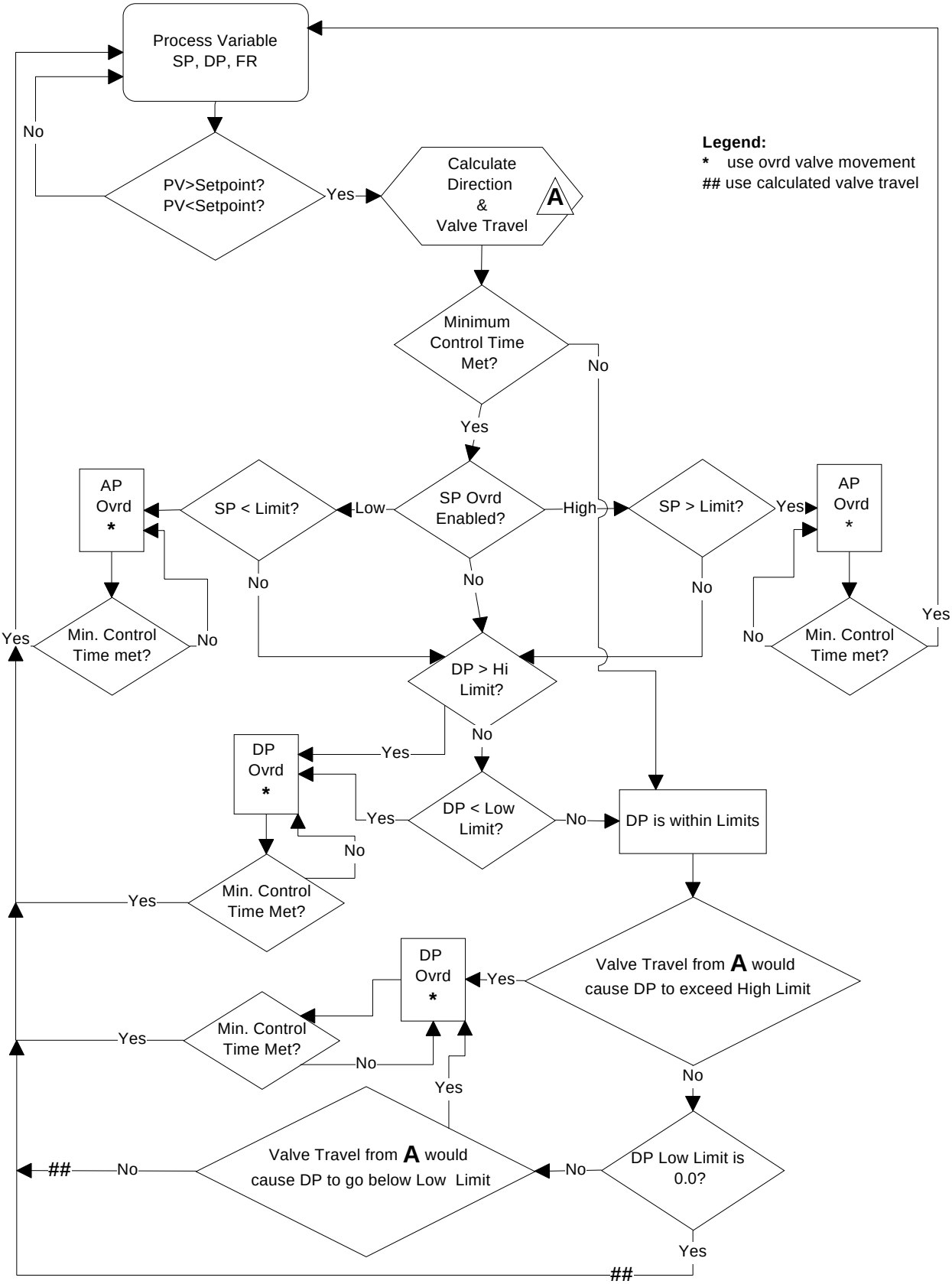
   B) If the DP low limit is not zero and the process variables calculated direction is to close the valve but its' valve travel is greater than that calculated for DP, a DP override low is asserted and the valve will close only as far as the distance calculated for the DP travel.

   DP high or DP low override will now control for the minimum control time based on whether option A or B was found to be true.

Important:
Due to condition 5 above, it is imperative for proper valve control operation that the DP limits be configured even if the process variable chosen for control is static pressure or flow rate. Unpredictable results and loss of control will be seen if DP is not configured.

When the minimum control time has been met, the system releases a lock allowing any other process to pick up minimum control time control. Allowing DP high override to bypass this lock is to provide protection for the transducer. The flow chart outlining this process just described follows on the next page.

Analog Valve Control



Override Conditions:

As seen in the basic valve control section, overrides can occur for either SP or DP conditions. Some of the finer points will be discussed on these operations in this section.

DP override uses the values entered for Set Point, Hi Limit, Lo Limit, Dead Band, and Gain to determine if an override condition exists and to calculate the DP valve travel. DP high override is always enabled as protection for the transducer and as such when a process variable is in control DP high is allowed to override whether or not the minimum control time has been met for the process variable. It is possible to disable the DP low override condition by setting the DP Lo Limit to zero. DP values must be configured no matter what process variable is being used, otherwise the controller can not control.

SP override operates in either the High mode or Low mode. In high mode an SP override condition exists if the current SP goes above the value entered for the SP Override Limit, and in low mode an override exists if the current SP goes below this limit. The current SP is always comes from the FCU when the valve location is upstream. However, if the valve location is downstream it is necessary to configure an external analog input to provide the SP information to the FCU. While Set point, Hi Limit, Lo Limit, Dead Band, and Gain are not used to determine if an override condition exists for SP as they were in DP override, they are used to calculate the valve travel for SP override and thus should also be configured when using SP override.

Shut-in Override Mode:

DP:
The purpose of the shut-in mode for DP is to shut in the well by closing the valve if the DP measurement cannot be kept high enough to provide accurate measurement and control. Shut-in mode checks for continuous minutes of the condition where the valve is full open and the DP remains below its' low limit. If this condition persists for the amount of time specified by DP Low Time, the valve is ramped closed. The Fail Closed status, Low DP Override status, Shit-in status, and the Full Closed Status are all set.

Once the shut-in status has been set, automatic control is suspended. The controller may be instructed to restart manually by sending a control mode command Control may also be restarted automatically by one of the following three methods:

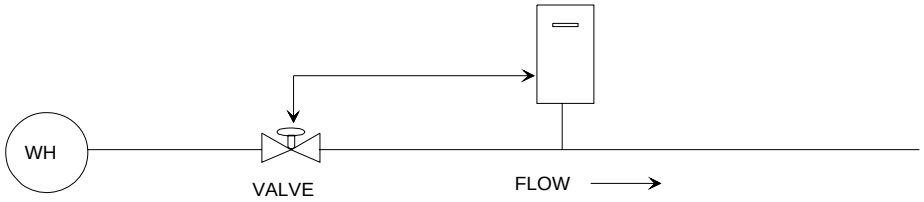
1) At the end of the time period specified with DP Shut-in Period.
2) In response to an external event signified by contact closure on the specified discrete input channel. (These will be listed in a later section.)
3) Selecting "React on SP Hi" for the DP Shut-in option.

If further information is desired on these options, reference the PCCU32 online help guide.

SP:
The purpose of the SP override shut-in is much the same as that for DP. However, there are only two methods for restarting the controller after shut-in has occurred.

1) If using Low SP Override, the static pressure must go above the value set for SP Restart.
2) If using High SP Override, the static pressure must go below the value set for SP Restart.

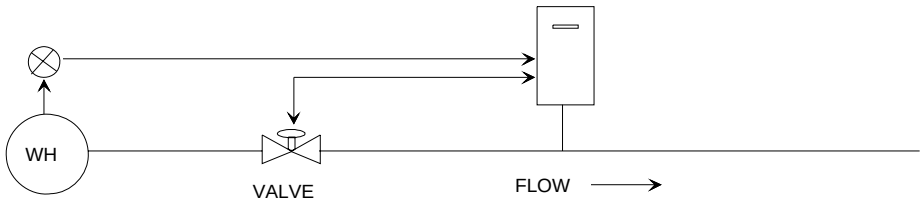
On the following pages are charts which summarize the use and actions of the override conditions.



SET UP: Valve Location = Up Stream
AI Select = None

CONTROLER INPUTS: Flow = FCU AP & DP
DP = FCU
AP = FCU

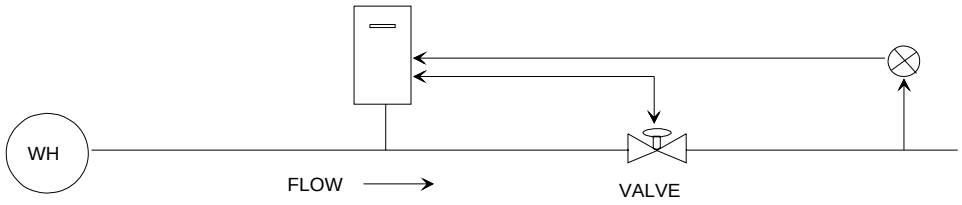
					RESTART ON:	
OVERIDES:	**SETTINGS:**	**OVERIDE CONDITIONS:**	**VALVE ACTION:**	**Ext. Evt= Restart cont.**	**Timer**	**AP**
DP	DP Lo SI=Normal	(Valve=FOP)&(DP<DPLoLimit)& (Time>=DPLotime)	Close	DI8=Close	VCL time > Shut in time	N/A
DP	DPloSI=React AP Hi	(Valve=FOP)&(DP<DPLoLimit)& (Time>=DPLotime)	Close	DI8=Close	VCL time > Shut in time	FCU AP > AP HI Lim.
AP	AP overide=Enable Hi	FCU AP > APOV	Close	N/A	N/A	FCU AP < AP Rstrt
	AP overide=Enable Lo	FCU AP < APOV	Close	N/A	N/A	FCU AP > AP Rstrt
DI8	Ext. Evt. = Fail Close	DI8 = Contact Closure	Close		Manual Restart Controller	
Low Battery	On Lo Batt. = Close	Battery Voltage < Lo Batt.	Close		Battery Voltage > Lo Batt.	
	On Lo Batt. = Freeze	Battery Voltage < Lo Batt.	Freeze		Battery Voltage > Lo Batt.	



SET UP: Valve Location = Up Stream
AI Select = Yes

CONTROLER INPUTS: Flow = FCU AP & DP
DP = FCU
AP = (AI - FCU AP) + FCU AP

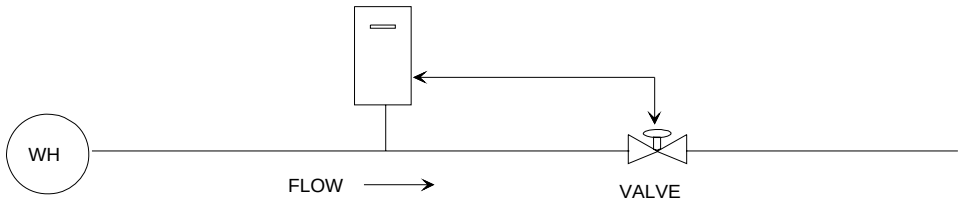
					RESTART ON:	
OVERIDES:	**SETTINGS:**	**OVERIDE CONDITIONS:**	**VALVE ACTION:**	**Ext. Evt= Restart cont.**	**Timer**	**AP**
DP	DP Lo SI=Normal	(Valve=FOP)&(DP<DPLoLimit)& (Time>=DPLotime)	Close	DI8=Close	VCL time > Shut in time	N/A
DP	DPloSI=React AP Hi	(Valve=FOP)&(DP<DPLoLimit)& (Time>=DPLotime)	Close	DI8=Close	VCL time > Shut in time	AI > Cont. AP HI Lim.
AP	AP overide=Enable Hi	FCU AP > APOV	Close	N/A	N/A	FCU AP < AP Rstrt
	AP overide=Enable Lo	FCU AP < APOV	Close	N/A	N/A	FCU AP > AP Rstrt
DI8	Ext. Evt. = Fail Close	DI8 = Contact Closure	Close		Manual Restart Controller	
Low Battery	On Lo Batt. = Close	Battery Voltage < Lo Batt.	Close		Battery Voltage > Lo Batt.	
	On Lo Batt. = Freeze	Battery Voltage < Lo Batt.	Freeze		Battery Voltage > Lo Batt.	



SET UP: Valve Location = Down Stream
AI Select = Yes

CONTROLER INPUTS: Flow = FCU AP & DP
DP = FCU
AP = FCU

					RESTART ON:	
OVERIDES:	**SETTINGS:**	**OVERIDE CONDITIONS:**	**VALVE ACTION:**	**Ext. Evt= Restart cont.**	**Timer**	**AP**
DP	DP Lo SI=Normal	(Valve=FOP)&(DP<DPLoLimit)& (Time>=DPLotime)	Close	DI8=Close	VCL time > Shut in time	N/A
DP	DP Lo SI=React AP Hi	(Valve=FOP)&(DP<DPLoLimit)& (Time>=DPLotime)	Close	DI8=Close	VCL time > Shut in time	FCU AP>Cont. AP HI Lim.
AP	AP overide=Enable Hi	AI > APOV	Close	N/A	N/A	AI < AP Rstrt
	AP overide=Enable Lo	AI < APOV	Close	N/A	N/A	AI > AP Rstrt
DI8	Ext. Evt. = Fail Close	DI8 = Contact Closure	Close		Manual Restart Controller	
Low Battery	On Lo Batt. = Close	Battery Voltage < Lo Batt.	Close		Battery Voltage > Lo Batt.	
	On Lo Batt. = Freeze	Battery Voltage < Lo Batt.	Freeze		Battery Voltage > Lo Batt.	



SET UP: Valve Location = Down Stream
AI Select = None

CONTROLER INPUTS: Flow = FCU AP & DP
DP = FCU
AP = FCU

					RESTART ON:	
OVERIDES:	**SETTINGS:**	**OVERIDE CONDITIONS:**	**VALVE ACTION:**	**Ext. Evt= Restart cont.**	**Timer**	**AP**
DP	DP Lo SI=Normal	(Valve=FOP)&(DP<DPLoLimit)& (Time>=DPLotime)	Close	DI8=Close	VCL time > Shut in time	N/A
DP	DP Lo SI=React AP Hi	(Valve=FOP)&(DP<DPLoLimit)& (Time>=DPLotime)	Close	DI8=Close	VCL time > Shut in time	FCU AP>Cont. AP HI Lim.
AP	AP overides not active unless AI is selected.		N/A	N/A N/A	N/A N/A	N/A N/A
DI8	Ext. Evt. = Fail Close	DI8 = Contact Closure	Close		Manual Restart Controller	
Low Battery	On Lo Batt. = Close	Battery Voltage < Lo Batt.	Close		Battery Voltage > Lo Batt.	
	On Lo Batt. = Freeze	Battery Voltage < Lo Batt.	Freeze		Battery Voltage > Lo Batt.	

Low Battery Valve Action:

If the battery voltage falls below that specified for Low Battery limit, the valve is either frozen at its' current position or is ramped closed. The Low Battery status bit will be set. Only a manual restart of the controller is possible with this condition. This may be set through PCCU32 during configuration or alternatively through parameter #13 in the PID Point Type. Valid settings are:

Value	Action
0	Close Valve
1	Freeze Valve

Valve Control Commands:

While it is a straight forward procedure to configure valve control with PCCU32, this section will describe how to use the Block protocol to reconfigure needed parameters. The following table lists the commands for basic configuration of the analog valve controller:

Control Mode Command	*Hex Value*
Controller Off	0010
DP	0004
Flow Rate	0005
SP	0006
Shut-in Override	0008
Step Open	0014
Step Closed	0015
Ramp Open	0016
Ramp Closed	0017

Only one control mode may be active at any time. For instance, if operating in Flow Rate control and a ramp closed command is given, after the valve has ramped closed, the controller will then be in the off mode.

This next table lists the more advanced options which work in conjunction with the basic commands DP, Flow Rate, SP, and Shut-in override.

Configuration Command	Hex Value	Option	
SP Type	0040	0 = High	1 = Low
SP Override	0080	0 = Disabled	1 = Enabled
Transmitter AI	0300	0 = None	x = AI # for transmitter
Shut-in Timer Units	0800	0 = Minutes	1 = Hours
Valve Location	1000	0 = Down Stream	1 = Up Stream
DP Shut-in Options	2000	0 = Fail Close	1 = Restart on SP High
External Event Mode	4000	0 = Fail Close	1 = Restart

To configure the controller, pick which controls and options are needed for the current setup. Add the corresponding hex values, convert to a decimal value and write this value into parameter #17 'Control Type' in any of the PID point types. While the control type is the same for all three PID logical numbers, it is recommended that the user enter the command for DP control, Flow Rate control, and SP control in the proper logical number PID so that all effective changes may be viewed once the write is complete.

As an example, consider setting the following configuration:

Configuration #1	Hex Value	Action
Flow Rate	0005	Flow Rate Primary Control
SP Type	0000	SP Override High
SP Override	0080	Enable SP Override
Valve Location	1000	Upstream
	1085 = 4229 decimal	

By entering 4229 for 'Control Type' in the PID Point Types, configuration is complete for this controller. If it was later decided to turn off SP override the following logic would be followed:

Configuration #2	Hex Value	Action
Flow Rate	0005	Flow Rate Primary Control
SP Type	0000	SP Override High
SP Override	0000	Disable SP Override
Valve Location	1000	Upstream
	1005 = 4101 decimal	

When reading parameter #17 of the PID point type several factors should be considered when doing the conversion to understand what is occurring in the control operation. If a read is performed after Configuration #1 has been sent, a value of -28539 will be displayed for parameter #17. This is a decimal value which must be converted to hex for interpretation. For this case, the hex value is FFFF9085. The following table gives a breakdown of how to interpret this value.

Hex Value	Interpretation
FFFF0000	Explanation Below
1000	Valve Location Upstream
8000	Ack Bit (explanation below)
0080	SP Override Enabled
	SP Type = High xx0x
0005	Flow Rate Primary Control
FFFF9085	

The leading FFFF is due to converting from an integer type in the flow computer to a float value to send to the host and should be ignored. The Ack bit, 8000, is a status passed between the FCU and the analog interface card.

Valve Control Status Bits:

Parameter #20 of the PID Point Types is used to view the current status of the valve. Using the following tables it is possible to interpret the data value displayed. The following table gives the bit weights for the valve control status flags.

Status	*Hex Value*
Valve Full Open	0010
Valve Full Closed	0020
High DP Bit	0040♦
Low DP Bit	0080♦
DP Override	0080
SP Override	0040
Fail Bit	0100
Low Battery Bit	0200
Local Lockout Bit	0400
Shut-in Bit	0800

♦ Not valid when SP Override is enabled. Only a DP Override or SP Override condition will be displayed.

In addition to the status flags, information on the control mode and some of the options are returned in the status word. The bit weights for these are given in the table below and should be used with those from the status table to decipher the current status of the valve control operation.

Control Mode Command	*Hex Value*	*Options*	
DP	0004	None	
Flow Rate	0005	None	
SP	0006	None	
Shut-in Override	0008	None	
Step Open	0014	None	
Step Closed	0015	None	
Ramp Open	0016	None	
Ramp Closed	0017	None	
Valve Location	1000	0 = Down Stream	1 = Up Stream
DP Shut-in Options	2000	0 = Fail Close	1 = Restart on SP High
External Event Mode	4000	0 = Fail Close	1 = Restart

As in dealing with previous tables, it is necessary to convert the decimal value displayed to a hex value to correlate with the above tables. To aid in learning how to interpret the returned values, several example are given below.

Example #1:

A value of 4172 is read from the display. Converted to hex this gives a value of 104C. The following table shows the breakdown of this hex value.

Hex Value	Description
1000	Valve Location Up Stream
0040	SP Override Condition Exists
0008	Shut-in Override Enabled
0004	DP Control Mode
104C	

Example #2:

A value of 13 is read from the display. Converted to hex this gives a value of D.

Hex Value	Description
0008	Shut-in Override Enabled
0005	Flow Rate Control Mode
000D	

Example #3:

A value of 14765 is read. In hex, this equates to 39AD.

Hex Value	Description
1000	Valve Location Up Stream
2000	Restart on SP High
0100	Fail Bit
0800	Shut-in Bit
0020	Valve Full Closed
0080	Low DP Override
0005	Flow Rate Control Mode
0008	Shut-in Override Enabled
39AD	

PID Point Type Parameter Descriptions:

While most of the PID parameters have been defined in the 'Terminology' section earlier, several parameters and their implementation need to be discussed. The PID Point Type has been configured to have three logical numbers, one for each primary process variable. These are outlined in the table below:

Process Variable	*Logical Number*
DP	0
SP	1
Flow Rate	2

For any parameter listed as 'Primary' the value returned will depend on which PID logical number is being viewed at the time. For instance, if viewing logical number 2 parameter #6 "Primary High Limit", the value would be that of the high limit entered for flow rate. On the other hand, if viewing logical number 0 the value would be the DP high limit.

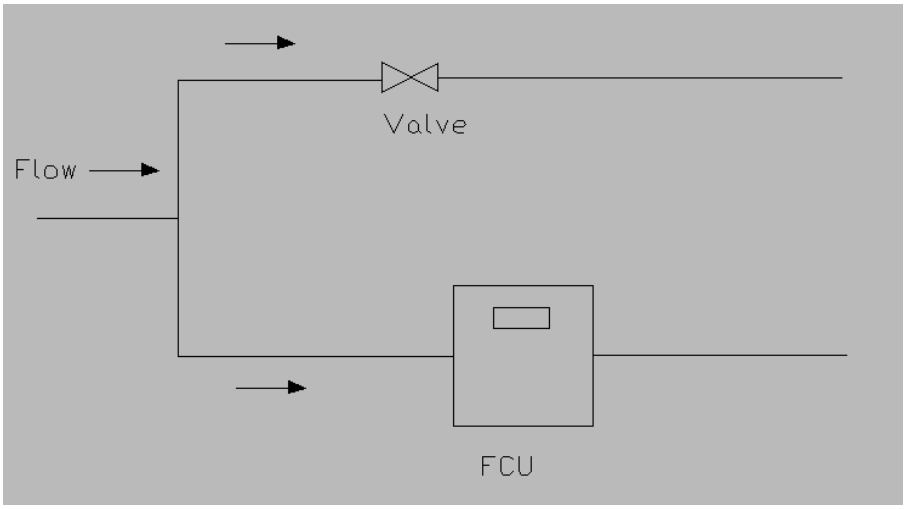
Below are descriptions of parameters which have not been defined elsewhere. These parameters are the same registers and thus the same data regardless of which logical number is being viewed.

Switch Status – who has control. The following table lists the appropriate values.

Control	Value
Primary Controller	1
DP Override	2
SP Override	3

Reverse action – set to a one (1) to activate. One scenario where this might be used is when the flow computer is measuring at one location and needs to control a valve at another location in a parallel run. The determination of valve direction at the measurement location is actually the opposite of what needs to occur at the location where the valve resides.

Example: The flow rate at the FCU needs to increase. The flow computer would interpret this as opening the valve. However, since the valve action will take place at location 2, the valve direction here should close to increase the flow across location 1.



Primary Input Point – three byte data type which allows the setting of the analog input to use. Each member of the data type is a single character. The allocation of these characters is shown in the table below.

Description	Member #
Point Type	1
Analog Input	2
Parameter	3

For Totalflow implementation member #2 is the only member which has an action associated with it. The other members may be used for 'bookkeeping' purposes as desired.

Example:
Entering 3,1,0 would set analog input number 2 as the AI to use for inputs. The 3 is merely a reminder to the user that AI's are located in Point Type #3.

Primary Output Point – same as the Primary Input Point above, except member #2 selects which analog output to use.

Description	Member #
Point Type	1
Analog Output	2
Parameter	3

Primary Switch Process Variable – user can enter any meaningful data that is desired, but no action occurs because of this data.

Primary Loop Period – sets the time (in mSec) between valve control calculations. The default value for analog valve control is 3000mSec. In Totalflow Console Mode this item is called 'Contrl Dly'.

Primary Process Variable – display the current value for this PID's process variable.

Analog Valve Position – display the current valve position in percent.

Discrete Inputs and Valve Control:

With analog valve control enabled, the discrete inputs have certain restrictions applied to them. The default configuration of the Valve Control Interface (VCI) discrete inputs is shown below.

VCI Discrete Input	*Function*
1	Local Lockout
2	Full Open
3	Full Close
4	External Event

It is possible through Console Mode in PCCU32 to change which DI is used for Local Lockout and for an External Event. The possibilities are:

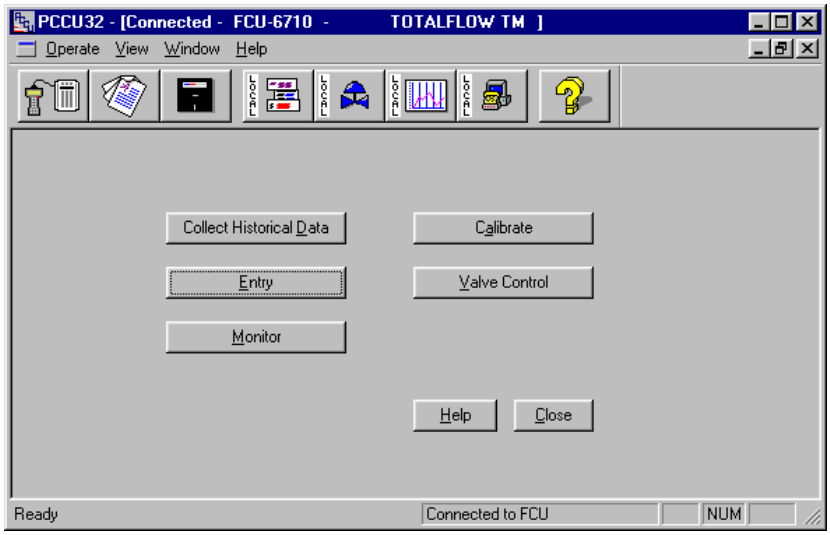
Input♣
Default VCI Discrete Input
Onboard DI #0
Onboard DI #1
Security Switch

♣The same input should not be selected for use by more than one function.

XXVII. Basic Configuration

This section will present a method for configuring the flow computer for use using PCCU32 version 3.10.1. It is necessary to calibrate the analog inputs and outputs before they can be used. These topics and other valve control setup issues will be discussed here.

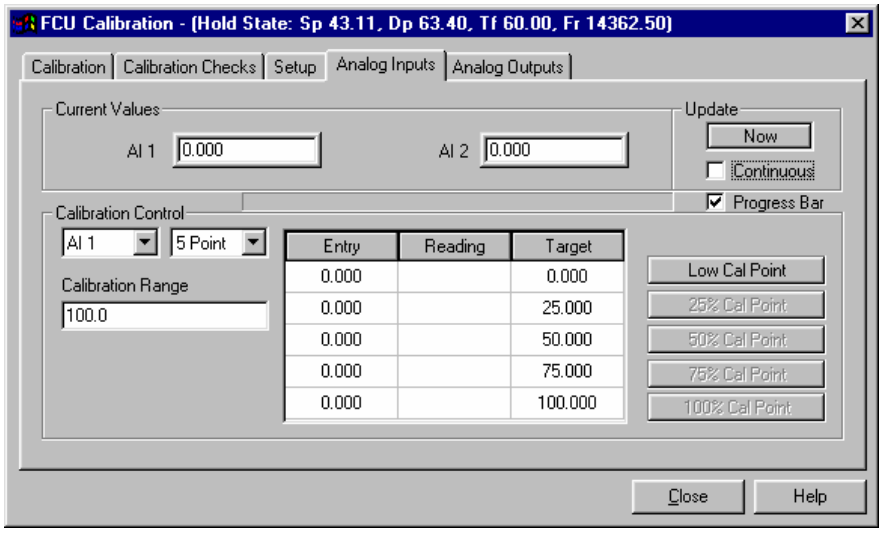
After bringing the program up, select *Operate* | System *Setup* to check that the *Query All Commands* checkbox has been enabled. Now it is time to connect to the FCU via the local port using PCCU32. This may be accomplished by clicking the 'Connected to Totalflow' icon  or by selecting *Operate* | *Connect to Totalflow* , at which point the program will attempt to connect with the flow computer. The program will check the security code, version, and query all commands. Once connected the following screen will appear:



From this screen it is possible to completely configure the flow computer for use.

Analog Input Calibration:

Click on the Calibrate button and when the calibrate screen appears, select the Analog Inputs tab to view the following screen:



The Current Values section will display the current values continuously by checking the Continuous box or on demand by clicking the Now button. It is recommended that the Continuous box not be checked during a calibration. The Progress Bar if checked, will show any communication between the PCCU and the flow computer.

Step 1 Connect an accurate power source capable of 1 - 5 volts to the AI terminals to be calibrated.
6700 Models: AI 1 (+) J13 Pin 1 AI 1 (-) J13 Pin 2
AI 2 (+) J13 Pin 3 AI 2 (-) J13 Pin 4

Step 2 Under Calibration Control, select the AI to be calibrated from the drop down dialog box.

Step 3 Under Calibration Control, select whether to do a 3 Point or 5 Point calibration. Note that if 3 Point is selected, there will be 3 Target values and 3 Cal Point buttons. If 5 Point is selected, there will be 5 Target values and 5 Cal Point buttons.

Step 4 Click inside the Calibration Range window and enter a range. The range can be any thing and represent any units (percent, volts, .etc.) the user wants. Target values will be updated to reflect the new Calibration Range.

Step 5 Click on the Low Cal Point button and apply the voltage for the low calibration point and verify the Current Reading on the Enter Low Calibration Value screen is stable.

Step 6 Enter the Target value for the Low Cal Point and click the OK button.

Step 7 Click on the 100% Cal Point button and apply the voltage representing the full range and verify the Current Reading is stable.

Step 8 Enter the Target value for the 100% Cal Point and click the OK button.

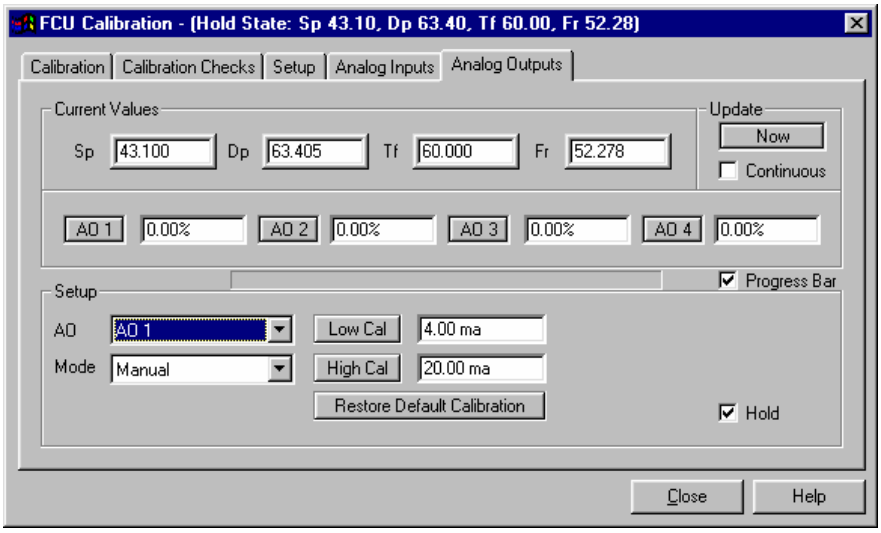
Step 9 Click on the next highest Cal Point button and apply a voltage representing it's range and verify the Current Reading is stable.

Step 10 Enter the Target value for that Cal Point and click the OK button.

Step 11 Repeat Steps 9 - 10 for any remaining Cal Points. After the last point is entered, the PCCU will automatically calibrate the AI.

Analog Output Calibration:

Analog outputs are also accessible through the Calibrate tab. The following window should be displayed when selecting the Analog Outputs tab.



The analog outputs can be set to output a constant current or output current proportional to Static Pressure, Differential Pressure, Flow Rate or Temperature.

The Current Values section will display the current values continuously by checking the Continuous box or on demand by clicking the Now button. It is recommended that the Continuous box not be checked during a calibration. The Progress Bar if checked, will show any communication between the PCCU and the flow computer.
The following procedure is for the calibration and setup of one analog output. The procedure will be the same for any additional analog outputs.

Calibrating an Analog Output:

Step 1 Connect a meter capable of reading 4 - 20 ma signal to the analog output terminals to be calibrated.
Step 2 Verify that the Hold box is checked in the lower right portion of the screen.
Step 3 Select the appropriate analog output from the AO drop down dialog box in the Setup section.
Step 4 Select Manual from the Mode drop down dialog box in the Setup section.
Step 5 Click on the Low Cal button and verify that the meter reading has stabilized at approximately 4 ma.
Step 6 Enter the meter's reading in the Enter Measured Value window and click the OK button.
Step 7 Click on the High Cal button and verify that the meter reading has stabilized at approximately 20 ma.
Step 8 Enter the meter's reading in the Enter Measured Value window and click the OK button.
Step 9 To test the calibration, click on the appropriate AO button just above the Setup section and enter a value 0 - 100% and note the reading on the meter. (25% = 8 ma, 50% = 12ma, 75% = 16 ma, 100% = 20 ma)
Step 10 If the calibration is not satisfactory, repeat steps 5 thru 8.

Assigning a Process Variable to an Analog Output:

Step 1 Select the appropriate analog output from the AO drop down dialog box in the Setup section.

Step 2 Select the Process Variable from the Mode drop down dialog box in the Setup section.

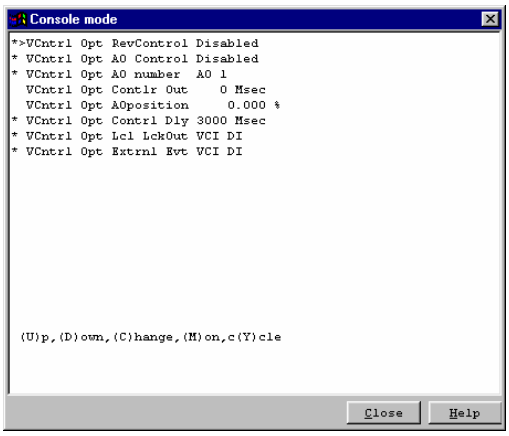
Step 3 If Proportional to Flow was selected in Step 2, a Units dialog box will appear. Select the desired Units (scf/hr, mcf/day or mmcf/day) for the flow rate.

Step 4 Enter the Low Value and High Value in the units of the variable you are tracking. The Low Value representing 4 ma or 0 % and the High Value representing 20 ma or 100%. Units for SP and DP depend on setup in the Calibration tab.

Step 5 The Hold box can be unchecked and the Now or Continuous Update mode selected to see the appropriate AO window tracking the selected variable.

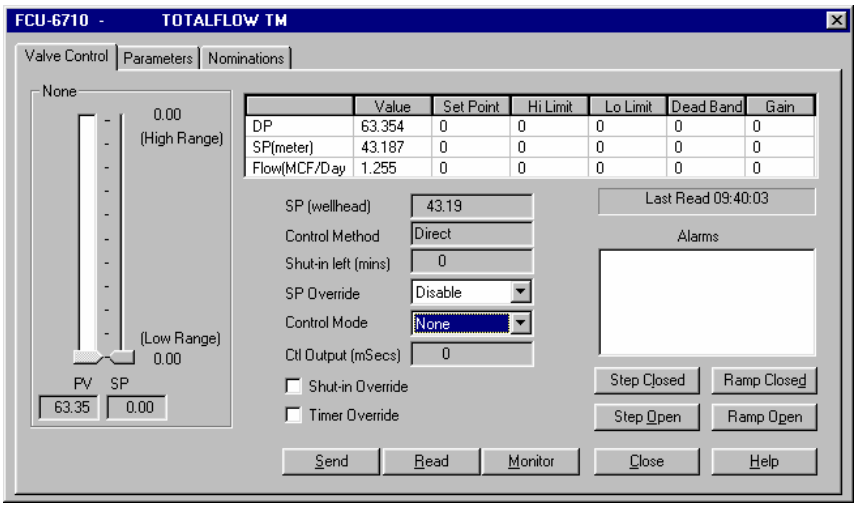
Valve Control:

From the Connected to Totalflow window, select *Operate* | *Console Mode* and then select *VCntrl Opt* and the following screen should appear:



Using the 'D' key of the keyboard, move the > enunciator down to the second VCntrl Opt, hit 'C' to change this option, space bar to select "enabled", and 'Enter' key to set. Next, move down to the third option to select which AO will be used for valve control. If it is desired to change the Primary Loop Delay(Contrl Dly) it may be done here as well as changing which discrete inputs are used for local lockout and external events. The options for these DI's are shown in a table under the topic Discrete Inputs and Valve Control. When finished with changes to this screen *Close* to exit console mode.

From the Connected to Totalflow window, select *Valve Control*. The following screen will appear:

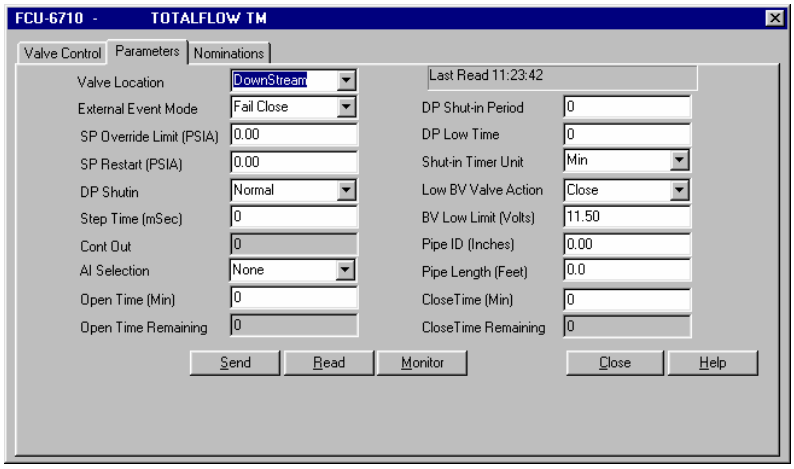


If the analog output to be used for valve control is at a setting other than 0%, ramp the valve closed. This will put the AO and valve into a known start position.

Descriptions of all the parameters associated with valve control are available in PCCU32 on-line help, so only the basic fields necessary to configure the unit are discussed here. Enter values for Set Point, Hi Limit, etc. by clicking on the appropriate field. Select the desired control mode from the drop down box.

Important:
For valve control to operate properly, values must be entered for all DP fields even if SP or Flow Rate are selected as the process variable to control on.

After configuring valve control, switch to the Parameters tab to configure other aspects of control.



Enter a value for Step Time, as this will be used as the value used when a valve is initially opened from a full closed position. Configure other necessary parameters needed for the application.

General Setup:

To configure the rest of the flow computer for operation go to the *Entry* tab on the Connected to Totalflow page. This will present a wide variety of options for configuring communications ports, selecting factors to use in calculations and various other selections.