

DATA 2458

ORDINAL POINT ASSIGNMENTS FOR CL5A REGULATOR CONTROL

For Use With Data 2179 Protocol

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**CL5 REGULATOR CONTROL COMMUNICATIONS INTERFACE
SEQUENCE NUMBER AND ORDINAL MEMORY ADDRESS ASSIGNMENTS**

for the Cooper Power Systems subset of the PG&E Protocol

Revision 01.....	June 14, 1991 (UNDER CONSTRUCTION)
Revision 02.....	June 12, 1992 (UNDER CONSTRUCTION)
Revision 03.....	October 13, 1992 (UNDER CONSTRUCTION)
Revision 04.....	December 7, 1993
Revision 05.....	February 2, 1994

Note: The following definitions apply to the tables below:

“Scale Factor” is factor by which a signed integer value read from the CL5 is divided to get the value of the variable in the indicated units.

“Function code” is the code used to access the parameter through the CL5 frontpanel controls, if applicable, and is listed for information only.

“Cross Reference” is with reference to the control’s internal data base, and is listed for designers’ information only. Not useful to user.

**INPUT SUBSYSTEM: Sequence numbers used in BASIC SCAN and
SCAN-BY-TABLE operations**

Simple Status data type...

SEQ # (HEX)	SCALE FACTOR	CROSS UNITS REF	FUNC CODE	DESCRIPTION	ADDITIONAL COMMENTS/NOTES
30		5-1		State of Display Annunciators	(0 = OFF, 1 = ON) Bit 0 - "LOW" Bandwidth Bit 1 - "HIGH" Bandwidth Bit 2 - "LOW" Voltage Limiting Bit 3 - "HIGH" Voltage Limiting Bit 4 - "V. RED." Voltage Reduction Bit 5 - Spare Bit 6 - Spare Bit 7 - Spare
		2-42	69	State of Regulation Task- (Blocked/Unblocked)	Bit 8 - 0 = Normal Automatic Operation 1 = Automatic Operation Inhibited
		1-13		Power Direction Indication	Bit 9 - 0 = Current flow is Determinate 1 = Current flow Indeterminate (Bit 10 is undefined) Bit 10 - 0 = Forward current flow 1 = Reverse current flow
		1-27		Control Power Direction Status	Bit 11 - 0 = Forward current flow 1 = Reverse current flow Bit 12 - New Min/Max Time-tagged Avail. Bit 13 - Spare Bit 14 - Spare Bit 15 - Spare
31		4-1		State of Auto/Off/Manual Switch	Bit 0 - 0 = OFF/MANUAL 1 = AUTO
		4-0		State of Voltage Reduction Inputs	Bit 1 - Reduction #1 Bit 2 - Reduction #2
4-7				State of Supervisory Switch	Bit 3 - Supervisory On Bit 4 - Spare Bit 5 - Spare Bit 6 - Spare Bit 7 - Spare Bit 8 - Spare Bit 9 - Spare Bit 10 - Spare Bit 11 - Spare Bit 12 - Spare Bit 13 - Spare Bit 14 - Spare Bit 15 - Spare

Pulse Accumulator input (counter) data type.....resettable

All data is 16-bit positive integer format.

SEQ # (HEX)	SCALE FACTOR	CROSS UNITS REF	FUNC CODE	DESCRIPTION	ADDITIONAL COMMENTS/NOTES
40	1	Repairs	0-1	93	Number of EPROM Corrections
41	1	Resets	0-2	94	Number of Resets (Insanity)
42	1		4-5	0	Operations Counter (100s)
43	1		4-6	0	Operations Counter (10s & 1s)

These two operation counter points must be concatenated to form the total count. (Reset will NOT be allowed through remote communication.)

Analog Input data type...

All data is signed 16-bit integer format.

SEQ # (HEX)	SCALE FACTOR	UNITS	CROSS REF	FUNC CODE	DESCRIPTION	ADDITIONAL COMMENTS/NOTES
80	1				CALIBRATION REFERENCE	Fixed at 90% of full scale. (29491/7333H)
81	1				CALIBRATION REFERENCE	Fixed at zero.
82	1		0-3	95	Hardware Status	
83	See Comments	Amps	1-1	9	Load Current (primary)	IF(CT RATIO <= 50) THEN 10, ELSE 1
84	10	Volts	1-2	6	Load Volts (secondary)	
85	1	KV	1-3	10	Load Volts (primary)	
86	10	Volts	1-4	7	Source Volts (secondary)	
87	100	KV	1-5	11	Source Volts (primary)	
88	1	KVA	1-8	14	KVA Load	
89	1	KVAR	1-9	16	KVAR Load	
8A	1	KW	1-10	15	KW Load	
8B	100		1-11	13	Power Factor	
8C	10	%	1-12	12	Percent Regulation	
8D	10	Volts	1-14	8	Compensated Volts (secondary)	
8E	10	%	1-15	18-3	3rd Voltage Harmonic	
8F	10	%	1-16	18-5	5th Voltage Harmonic	
90	10	%	1-17	18-7	7th Voltage Harmonic	
91	10	%	1-18	18-9	9th Voltage Harmonic	
92	10	%	1-19	18-11	11th Voltage Harmonic	
93	10	%	1-20	19-3	3rd Current Harmonic	
94	10	%	1-21	19-5	5th Current Harmonic	
95	10	%	1-22	19-7	7th Current Harmonic	
96	10	%	1-23	19-9	9th Current Harmonic	
97	10	%	1-24	19-11	11th Current Harmonic	
98	10	hertz	1-26	17	Line Frequency	
99	See Comments	Amps	3-0	22-P	Current Demand (forward present)	IF(CT RATIO <= 50) THEN 10, ELSE 1
9A	1	KVA	3-1	24-P	KVA Demand (forward present)	
9B	1	KVAR	3-2	26-P	KVAR Demand (forward present)	
9C	1	KW	3-3	25-P	KW Demand (forward present)	
9D	10	Volts	3-4	20-P	Load Volts Demand (forward present)	
9E	10	Volts	3-5	21-P	Compensated Volts Demand (forward present)	
9F	See Comments	Amps	3-6	32-P	Current Demand (reverse present)	IF(CT RATIO <= 50) THEN 10, ELSE 1
A0	1	KVA	3-7	34-P	KVA Demand (reverse present)	
A1	1	KVAR	3-8	36-P	KVAR Demand (reverse present)	
A2	1	KW	3-9	35-P	KW Demand (reverse present)	
A3	10	Volts	3-10	30-P	Load Volts Demand (reverse present)	
A4	10	Volts	3-11	31-P	Compensated Volts Demand (reverse present)	
A5	10	Volts	4-4		Tapchanger Calculated Motor Voltage	
A6	10		5-0	71	Voltage Reduction Active Remote	
A7	1		4-08	12-P	Present Tap Position	
A8	10	%	1-31	18-13	13th Voltage Harmonic	
A9	10	%	1-32	19-13	13th Current Harmonic	
AA	10	%	1-33	18-THD	Total Voltage Harmonic Distortion	
AB	10	%	1-34	19-THD	Total Current Harmonic Distortion	

TIME-TAGGED INFORMATION SUBSYSTEM:

Types and formats used in retrieving time-tagged information

TYPE 0, Time-tagged information record.....Minimum/maximum Demand Values

	<u>CODE/PARAMETER</u>		<u>SCALE FACTOR</u>	<u>UNITS</u>
	01...Max Forward Load Voltage		10	Volts
	02...Min Forward Load Voltage	10	Volts	Volts
	03...Max Forward Compensated Voltage	10	Volts	Volts
	04...Min Forward Compensated Voltage	10	Volts	Volts
	05...Max Forward Load Current	*	Amps	Amps
	06...Min Forward Load Current	*	Amps	Amps
07...Max Forward kVA	1	kVA		
08...Min Forward kVA	1	kVA		
09...Max Forward kW	1	kW		
10...Min Forward kW	1	kW		
11...Max Forward kVAR	1	kVAR		
12...Min Forward kVAR	1	kVAR		
13...Max Tap Position	1			
14...Min Tap Position	1			
	15...Max Reverse Load Voltage		10	Volts
	16...Min Reverse Load Voltage	10	Volts	Volts
	17...Max Reverse Compensated Voltage	10	Volts	Volts
	18...Min Reverse Compensated Voltage	10	Volts	Volts
	19...Max Reverse Load Current	*	Amps	Amps
	20...Min Reverse Load Current	*	Amps	Amps
21...Max Reverse kVA	1	kVA		
22...Min Reverse kVA	1	kVA		
23...Max Reverse kW	1	kW		
24...Min Reverse kW	1	kW		
25...Max Reverse kVAR	1	kVAR		
26...Min Reverse kVAR	1	kVAR		

* IF(CT RATIO <= 50) THEN 10, ELSE 1

TYPE 1, Time-tagged information record.....Regulator Load-profile Record

Event Type codes used: 00...this is a time event

Data values returned: Parameter Scale Factor Units

As defined by user with Function Code 85 or Ordinal 6, offset 4A - 51

CONTROL OUTPUT SUBSYSTEM:

Sequence numbers used in SELECT/OPERATE operations

SEQ # (HEX)	SCALE FACTOR	UNITS	CROSS REF	FUNC CODE	DESCRIPTION	ADDITIONAL COMMENTS/NOTES
00			4-3		Raise Tapchanger one tap	"Close" is only valid command.
01			4-3		Lower Tapchanger one tap	"Close" is only valid command.
02			2-42	69	Control Regulation Enable	"Close" = Blocked "Open" = Unblocked

CL5 MEMORY, ORDINAL BLOCK 0: CL5 error information file (R/W)

Table format per specification PGE RTU Protocol REV 11, Appendix 2

Error codes defined for CL5 control :

ERROR CODE (HEX)	ERROR RESPONSE BITS	DESCRIPTION	SPECIFIC DATA
			08 09 0A 0B 0C 0D 0E 0F
00		No Error	00 00 00 00 00 00 00 00
01	NOP&ERR	Illegal Command Code	CC 00 00 00 00 00 00 00
02	NOP&ERR	Illegal Sequence Number	SN 00 00 00 00 00 00 00
03	NOP&ERR	Illegal Scan-table Number	TN 00 00 00 00 00 00 00
04		Not Used	
05		Not Used	
06		Not Used	
07		Not Used	
08		Not Used	
09	RST&ERR	SBO Operate without Arm	SN 00 00 00 00 00 00 00
0A	RST&ERR	SBO Arm with another Arm Pending	SN 00 00 00 00 00 00 00
0B		Not Used	
0C	RST&ERR	Another request with SBO Armed	00 00 00 00 00 00 00 00
0D	RST&ERR	Another request with Write Pending	00 00 00 00 00 00 00 00
0E		Not Used	
0F		Not Used	
10	ERR ONLY	Previous SBO Operation not prfrmd. satisfctly.	SN LE 00 00 00 00 00 00
11	NOP&ERR	Illegal Function Code	00 00 00 00 00 00 00 00
12	NOP&ERR	Illegal Ordinal Number	ON 00 00 00 00 00 00 00
13	NOP&ERR	Illegal Ordinal Bias or Bias is out of range ON OL	OH CT CT 00 00 00
14	Note 1	Unsuccessful Data Read or Write	LE ON OL OH 00 00 00 00
15	NOP&ERR	Illegal time-tagged table Number	TN 00 00 00 00 00 00 00
20	ERR ONLY	Default Real Time Clock Data, Clock not Set	00 00 00 00 00 00 00 00
21	NOP&ERR	Illegal Real Time Clock Julian Day	JH JL HR MN SC 00 00 00
22	NOP&ERR	Illegal Real Time Clock HH:MM:SS	JH JL HR MN SC 00 00 00
23		Not Used	
24		Not Used	
25		Not Used	
26		Not Used	
27		Not Used	
28		Not Used	
29		Not Used	
2A		Not Used	
2B		Not Used	
2C		Not Used	
2D	ERR ONLY	Calculated Number of Events is out of range	EN 00 00 00 00 00 00 00
2E	Note 1	Recloser Main CPU Access Error	TO LE 00 00 00 00 00 00
2F	ERR ONLY	Basic Scan Database Access Error	TO LE 00 00 00 00 00 00

Note 1: Responds with ERR only for "Reads", and NOP & ERR for "Writes"

LEGEND

CC	Command Code
CT	Count
EN	Event Number
JH	Julian Day High Byte
JL	Julian Day Low Byte
HR	Hour
LE	Local Control Error as follows ...
	01 Control is in "Local Mode"
	02 Requested Data is Invalid
	03 Requested Data is Invalid and Default
	04 Reserved
	05 Value is too Large
	06 Value is too Small
	07 Invalid Internal Point Offset
	08 Invalid Operation for this Internal Point
	09 Invalid Internal Point Number
	0A Invalid Number of Internal Points
	0B Mechanism Does Not Respond to Command
	0C Not Used
	0D Not Used
	0E Not Used
	0F Not Used
MN	Minute
OH	Ordinal Offset, High Byte
OL	Ordinal Offset, Low Byte
ON	Ordinal Number
SC	Seconds
SN	Sequence Number
TO	Time-Out Indication (FF if true, other data is irrelevant)
TN	Table Number

CL5 MEMORY, ORDINAL BLOCK 3: SCAN-BY-TABLE scan tables (R/W)

NOTE: Scan table data is stored in non-volatile memory in the CL5 Control. It is not required to re-initialize the data from the master after a reset.

Table format per specification...maximum length is 256 bytes

*** For more detailed information about this table's format, refer to (SPEC. DATA-2179, pg. 14-18 of 42, sec. 3.4) ***

CL5 MEMORY, ORDINAL BLOCK 5: CL5 RAM (R)

All data is 2 bytes long, low byte first.

OFF SET	SCALE FACTOR	UNITS	CROSS REF	FUNC CODE	DESCRIPTION	ADDITIONAL COMMENTS/NOTES
0000	100	0-0	89		Software Version/Device Number	
0002		0-6	61		Control Communication Type/revision	
0004		1-28	47		Voltage Calibration	
0006		1-30	48		Current Calibration	

CL5 MEMORY, ORDINAL BLOCK 6: CL5 Parameter Table (R/W)

NOTE: Parameter Table data is stored in non-volatile memory in the CL5 Control.
It is not required to re-initialize the data from the master after a reset.
All data is 2 bytes long, low byte first.

OFF SET	SCALE FACTOR	UNITS	CROSS REF	FUNC CODE	DESCRIPTION	ADDITIONAL COMMENTS	LIMITS	
							HIGH	LOW
0000	10	seconds	2-1	46	Demand Time Interval		60.0	3.0
0002	1	Amps	2-2	45	C.T. Primary Rating		2000	25
0004	10		2-3	44	P.T. Ratio	300.0	20.0	
0006	1	Volts	2-4	43	System Line Voltage	36000	2400	
0008	10	Volts	2-8	52	Bandwidth(reverse)		6.0	1.0
000A	10	Volts	2-9	55	Line Drop Compensation Reactive(reverse)		24.0	-24.0
000C	10	Volts	2-10	54	Line Drop Compensation Resistive(reverse)		24.0	-24.0
000E			2-11	56	Reverse Sensing Method	0 = Locked Forward 1 = Locked Reverse 2 = Reverse Idle 3 = Bi-Directional 4 = Neutral Idle 5 = Co-Generation	5	0
0010	10	Volts	2-12	51	Set Voltage(reverse)	135.0	100.0	
0012	1	seconds	2-13	53	Time Delay(reverse)	180	5	
0014	1	%	2-14	57	Reverse Threshold Value %		5	1
0016	1		2-15	40	Regulator Identification		32766	1
0018	1		2-16	96	Level 1 Security Code		9999	1
001A	1		2-17	97	Level 2 Security Code		19999	10000
001C	1		2-18	98	Level 3 Security Code		32766	20000
001E	1		2-19	41	Regulator Configuration	0 = Wye 1 = Delta Lag 2 = Delta Lead	2	0
0020	10	Volts	2-20	2	Bandwidth		6.0	1.0
0022	10	Volts	2-21	5	Line Drop Compensation Reactive		24.0	-24.0
0024	10	Volts	2-22	4	Line Drop Compensation Resistive		24.0	-24.0
0026			2-23	42	Control Operational Mode	0 = Sequential 1 = Time Integrating 2 = Averaging	2	0
0028	10	Volts	2-24	1	Set Voltage		135.0	100.0
002A	1	seconds	2-25	3	Time Delay		180	5
002C	1		2-26	80	Voltage Limiting Mode	0 = Off 1 = High Limit Only 2 = High and Low Limit	2	0
002E	10	Volts	2-27	81	High Voltage Limit		135.0	115.0
0030	10	Volts	2-28	82	Low Voltage Limit		115.0	105.0
0032	1		2-29	70	Voltage Reduction Mode	0 = Off 1 = Local 2 = Remote 3 = Pulsed Mode	3	0
0034	10	%	2-30	72	Local Voltage Reduction		10.0	0.0
0036	10	%	2-31	73	Remote Setting #1		10.0	0.0
0038	10	%	2-32	74	Remote Setting #2		10.0	0.0
003A	10	%	2-33	75	Remote Setting #3		10.0	0.0
003C	1	baud	2-40	60	Communication Channel #1 (Data Port) Baud Rate Code	1 = 300 2 = 1200 3 = 2400 4 = 4800	4	1
003E	1	baud	2-44	65	Communication Channel #2 (remote) Baud Rate Code	1 = 300 2 = 1200 3 = 2400 4 = 4800 5 = 9600	5	1

CL5 MEMORY, ORDINAL BLOCK 6: CL5 Parameter Table (R/W) (continued)

NOTE: Parameter Table data is stored in non-volatile memory in the CL5 Control.
It is not required to re-initialize the data from the master after a reset.
All data is 2 bytes long, low byte first.

OFF SET	SCALE FACTOR	UNITS	CROSS REF	FUNC CODE	DESCRIPTION	ADDITIONAL COMMENTS	LIMITS	
							HIGH	LOW
0040	1		2-43	64	Communication SCADA Address		32766	0
0042	1		2-45	66	Communication Channel #2 HandshakeMode Code	0 = No Handshaking 1 = RTS/CTS Active 2 = Modem Control Handshaking	2	0
0044	1	charact.	2-46	67	Communication Channel #2 Number of dead-line character times for re-synchronization		10	0
0046	1	millisec.	2-47	68-1	Communication Channel #2 Transmit Enable Delay for Modem Control Handshake Mode		425	0
0048	1	millisec.	2-48	68-2	Communication Channel #2 Transmit Disable Delay for Modem Control Handshake Mode		100	0
004A			2-50	85-1	Function Code of Parameter Stored at Load Profile Entry #1			
004C			2-51	85-2	Function Code of Parameter Stored at Load Profile Entry #2			
004E			2-52	85-3	Function Code of Parameter Stored at Load Profile Entry #3			
0050			2-53	85-4	Function Code of Parameter Stored at Load Profile Entry #4			
0052			2-54	76	Pulsed Mode: Number of Steps	10	1	
0054			2-55	77	Pulsed Mode: Step Size		10.0	0.1
0056			6-05	50-1	Time Calendar/Clock - Year		2089	1990
0058			2-80	92	Security System Bypass		3	1

CL5 MEMORY, ORDINAL BLOCK 0B: CL5 Psuedo-registers (R/W)

NOTE: These data are MAX/MIN registers for operating variables.
When they are written by the WRITE RTU MEMORY function, the write "data" is ignored and the registers are instead set to the current value of the operating variable. All data is signed 16-bit integer format.

OFF SET	SCALE FACTOR	UNITS	CROSS REF	FUNC CODE	DESCRIPTION	ADDITIONAL COMMENTS
0000	100		3-12	23-H	Power Factor at Maximum Demand KVA(forward)	
0002	100		3-13	23-L	Power Factor at Minimum Demand KVA(forward)	
0004	100		3-14	33-H	Power Factor at Maximum Demand KVA(reverse)	
0006	100		3-15	33-L	Power Factor at Minimum Demand KVA(reverse)	
0008	See Comments	Amps	3-16	22-L	Current Demand (forward minimum) IF(CT RATIO <= 50) THEN 10, ELSE 1	
000A	See Comments	Amps	3-17	22-H	Current Demand (forward maximum) IF(CT RATIO <= 50) THEN 10, ELSE 1	
000C	1	KVA	3-18	24-L	KVA Demand (forward minimum)	
000E	1	KVA	3-19	24-H	KVA Demand (forward maximum)	
0010	1	KVAR	3-20	26-L	KVAR Demand (forward minimum)	
0012	1	KVAR	3-21	26-H	KVAR Demand (forward maximum)	
0014	1	KW	3-22	25-L	KW Demand (forward minimum)	
0016	1	KW	3-23	25-H	KW Demand (forward maximum)	
0018	10	Volts	3-24	20-L	Load Volts Demand(forward minimum)	
001A	10	Volts	3-25	20-H	Load Volts Demand(forward maximum)	
001C	10	Volts	3-26	21-L	Compensated Volts Demand(forward minimum)	
001E	10	Volts	3-27	21-H	Compensated Volts Demand(forward maximum)	
0020	See Comments	Amps	3-28	32-L	Current Demand (reverse minimum) IF(CT RATIO <= 50) THEN 10, ELSE 1	
0022	See Comments	Amps	3-29	32-H	Current Demand (reverse maximum) IF(CT RATIO <= 50) THEN 10, ELSE 1	
0024	1	KVA	3-30	34-L	KVA Demand (reverse minimum)	
0026	1	KVA	3-31	34-H	KVA Demand (reverse maximum)	
0028	1	KVAR	3-32	36-L	KVAR Demand (reverse minimum)	

CL5 MEMORY, ORDINAL BLOCK 0B: CL5 Psuedo-registers (R/W)
(continued)

NOTE: These data are MAX/MIN registers for operating variables.

When they are written by the WRITE RTU MEMORY function, the write "data" is ignored and the registers are instead set to the current value of the operating variable. All data is signed 16-bit integer format.

OFF SET	SCALE FACTOR	UNITS	CROSS REF	FUNC CODE	DESCRIPTION	ADDITIONAL COMMENTS
002A	1	KVAR	3-33	36-H	KVAR Demand (reverse maximum)	
002C	1	KW	3-34	35-L	KW Demand (reverse minimum)	
002E	1	KW	3-35	35-H	KW Demand (reverse maximum)	
0030	10	Volts	3-36	30-L	Load Volts Demand (reverse minimum)	
0032	10	Volts	3-37	30-H	Load Volts Demand (reverse maximum)	
0034	10	Volts	3-38	31-L	Compensated Volts Demand (reverse minimum)	
0036	10	Volts	3-39	31-H	Compensated Volts Demand (reverse maximum)	
0038			3-40	27	Maximum % Boost/ Minimum % Buck	
003A			3-41	27	Minimum % Boost/ Maximum % Buck	
003C			3-66	27-H	Maximum Tap Position	
003E			3-69	28-L	Minimum Tap Position	

Data points accessible through front panel controls of the CL5, but not accessible through remote communications.

THESE DATA ARE NOT PART OF THE COMMUNICATIONS INTERFACE, AND ARE LISTED HERE FOR REFERENCE ONLY.

All data is 2 bytes long, low byte first.

OFF SET	SCALE FACTOR	UNITS	CROSS REF	FUNC CODE	DESCRIPTION	ADDITIONAL COMMENTS	LIMITS	
							HIGH	LOW
	1		0-4	62	Channel #1 (front panel) Status			
	1		0-5	63	Channel #2 (remote) Status			

