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11 | * IDEC LADDER LOGIC DOCUMENTATION SOFTWARE: *
12 | * CLIP VERSION 6.0 *
13 | * FILE:CEV24 *
14 | * DATE OF LAST MODIFICATION: OCTOBER 14, 1998 *
15 | * IDEC FA-2J PROGRAMMABLE CONTROLLER *
16 | * *
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18 | * Spare Parts Vendor: *
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24 | * *
25 | * ***** *
26 | * UNDERGROUND VAULT MONITORING AND CONTROL *
27 | * SYSTEM FOR A 24 FOOT CEV WITH TWO A/C UNITS, ONE *
28 | * ONE HEATER, AND AN APPENDAGE THERMOSTAT *
29 | * ***** *
30 | * *
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36 | * *
37 | * *
38 | * *
39 | * *
40 | * *
41 | * *
42 | * ===== *
43 | * SEQUENCE OF OPERATION *
44 | * ===== *
45 | * INTRODUCTION *
46 | * THE PLC (PROGRAMMABLE LOGIC CONTROLLER) *
47 | * MONITORS THE STATUS OF DIGITAL INPUTS (CONTACT *
48 | * CLOSURES) AND ANALOG INPUTS (TEMPERATURE AND *
49 | * HUMIDITY MEASUREMENTS). THE CONTROL LOGIC *
50 | * WITHIN THE PLC UPDATES THE PLC OUTPUTS (RELAY *
51 | * CONTACT CLOSURES) BASED ON THE INPUT STATUS, *
52 | * TIMING, AND INTERFACING LOGIC. THE INPUT *
53 | * MODULES HAVE A GREEN LABEL AND THE OUTPUT *
54 | * MODULES HAVE A RED LABEL. A 24 VOLT D.C. POWER *
55 | * SUPPLY POWERS THE ANALOG INPUT MODULE AND PASSES *
56 | * THE 24 VOLT D.C. POSITIVE CONNECTION TO THE *
57 | * INDIVIDUAL DIGITAL INPUTS WHEN THE INPUT *

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58 | * CONTACTS OR SWITCHES ARE CLOSED. | *
59 | * | *
60 | * A/C: TEMPERATURE CONTROL | *
61 | * WHEN THE MEASURED TEMPERATURE THAT IS READ INTO | *
62 | * PLC DATA REGISTER (D.R.) 812 RISES ABOVE THE | *
63 | * A/C ON SETPOINT STORED IN D.R. 817 THEN THE A/C | *
64 | * TURNS ON. WHEN THE MEASURED TEMPERATURE IN | *
65 | * D.R. 812 DROPS BELOW THE A/C OFF SUBTRACTION | *
66 | * SETPOINT STORED IN D.R. 819 THEN THE A/C TURNS | *
67 | * OFF. THE PLC AUTOMATICALLY CALCULATES THE A/C | *
68 | * OFF SETPOINT BY SUBTRACTING THE HYSTERISIS | *
69 | * VALUE IN D.R. 834 FROM THE A/C ON SETPOINT | *
70 | * THAT IS STORED IN D.R. 817. THE RESULT OF THIS | *
71 | * SUBTRACTION IS STORED IN D.R. 819. D.R. 819 | *
72 | * CAN BE MONITORED BUT THE VALUE CAN ONLY BE | *
73 | * CHANGED BY CHANGING D.R. 834. | *
74 | * ALL HVAC FUNCTIONS ARE DISABLED IN THE EVENT | *
75 | * OF A SMOKE ALARM. | *
76 | * A/C #1 IS PLC OUTPUT 212 | *
77 | * A/C #2 IS PLC OUTPUT 211 | *
78 | * | *
79 | * A/C: HUMIDITY CONTROL | *
80 | * WHEN THE MEASURED HUMIDITY THAT IS READ INTO | *
81 | * PLC DATA REGISTER (D.R.) 851 RISES ABOVE THE | *
82 | * HIGH HUMIDITY ALARM SETPOINT STORED IN D.R. 870 | *
83 | * THEN THE A/C TURNS ON. WHEN THE MEASURED | *
84 | * HUMIDITY IN D.R. 851 DROPS BELOW THE HIGH | *
85 | * HUMIDITY ALARM OFF SUBTRACTION SETPOINT STORED | *
86 | * IN D.R. 871 THEN THE A/C TURNS OFF. THE PLC | *
87 | * AUTOMATICALLY CALCULATES THE HIGH HUMIDITY ALARM | *
88 | * OFF SETPOINT BY SUBTRACTING THE HYSTERISIS | *
89 | * VALUE IN D.R. 882 FROM THE HIGH HUMIDITY ALARM | *
90 | * SETPOINT THAT IS STORED IN D.R. 870. THE RESULT | *
91 | * OF THIS SUBTRACTION IS STORED IN D.R. 871. D.R. | *
92 | * 871 CAN BE MONITORED BUT THE VALUE CAN ONLY BE | *
93 | * CHANGED BY CHANGING D.R. 882. | *
94 | * IF THE MEASURED TEMPERATURE IN D.R. 812 DROPS | *
95 | * BELOW THE SETPOINT IN D.R. 837 THEN THE A/C WILL | *
96 | * DEENERGIZE REGARDLESS OF HOW HIGH THE HUMIDITY | *
97 | * IS. | *
98 | * ALL HVAC FUNCTIONS ARE DISABLED IN THE EVENT | *
99 | * OF A SMOKE ALARM. | *
100 | * A/C #1 IS PLC OUTPUT 212 | *
101 | * A/C #2 IS PLC OUTPUT 211 | *
102 | * | *
103 | * HEAT: | *
104 | * WHEN THE MEASURED TEMPERATURE THAT IS READ INTO | *
105 | * PLC DATA REGISTER (D.R.) 812 DROPS BELOW THE | *
106 | * HEAT ON SETPOINT STORED IN D.R. 813 THEN THE | *
107 | * HEAT TURNS ON. WHEN THE MEASURED TEMPERATURE IN | *
108 | * D.R. 812 RISES ABOVE THE HEAT OFF ADDITION | *
109 | * SETPOINT STORED IN D.R. 815 THEN THE HEAT TURNS | *
110 | * OFF. THE PLC AUTOMATICALLY CALCULATES THE HEAT | *
111 | * OFF SETPOINT BY ADDING THE HYSTERISIS | *
112 | * VALUE IN D.R. 831 TO THE HEAT ON SETPOINT | *
113 | * THAT IS STORED IN D.R. 815. THE RESULT OF THIS | *
114 | * ADDITION IS STORED IN D.R. 815. D.R. 815 | *

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115 * CAN BE MONITORED BUT THE VALUE CAN ONLY BE *
116 * CHANGED BY CHANGING D.R. 831. *
117 * IF THE MEASURED TEMPERATURE IN D.R. 812 DROPS *
118 * BELOW THE SETPOINT IN D.R. 837 THEN THE HEAT *
119 * WILL ENERGIZE IF THERE IS A HIGH HUMIDITY ALARM. *
120 * ALL HVAC FUNCTIONS ARE DISABLED IN THE EVENT *
121 * OF A SMOKE ALARM. *
122 * HEATER IS PLC OUTPUT 215 *
123 * *
124 * HVAC CONTROLS: *
125 * AN ALTERNATOR IS USED TO ENSURE EQUAL USAGE OF *
126 * THE A/C. EACH A/C ALTERNATES WHICH ONE STARTS *
127 * FIRST. *
128 * *
129 * ----- *
130 * *
131 * ALARMS *
132 * ALL ALARMS ARE NORMALLY OPEN IN THIS CEV. *
133 * WHEN A FAULT IS DETECTED THE RESPECTIVE ALARM *
134 * OUTPUT CONTACT CLOSES ITS CONTACT. DURING *
135 * NORMAL CONDITIONS ALL ALARM CONTACTS SHOULD BE *
136 * OPEN INCLUDING OUTPUTS 200, 201, 202, 203, *
137 * 204, 205, 206, 207, AND 221. *
138 * *
139 * EXPLOSIVE GAS ALARM: OUTPUT 200 *
140 * IF INPUT 1 OPENS ITS CONTACT AN EXPLOSIVE GAS *
141 * ALARM IS DETECTED WHICH WILL ENERGIZE THE *
142 * EXPLOSIVE GAS ALARM RELAY OUTPUT 200. *
143 * *
144 * SUMP ALARM: OUTPUT 201 *
145 * IF INPUT 2 CLOSES ITS CONTACT A SUMP ALARM IS *
146 * DETECTED WHICH WILL ENERGIZE THE SUMP ALARM *
147 * RELAY OUTPUT 201. IF THE SUMP RUNS FOR LONGER *
148 * THAN 3 MINUTES THEN A SUMP ALARM IS ALSO *
149 * DETECTED WHICH ENERGIZES OUTPUT 201. *
150 * *
151 * PLC DIAGNOSTIC ALARM: OUTPUT 221 *
152 * IF A FAULT IS DETECTED THIS OUTPUT WILL GO ON *
153 * OR FLASH. THE FAULT MAY RELATE TO THE *
154 * TEMPERATURE/HUMIDITY SENSOR, 24 VOLT D.C. POWER *
155 * SUPPLY, OR THE ANALOG INPUT MODULE. *
156 * *
157 * INTRUSION ALARM: OUTPUT 204 *
158 * IF INPUT 6 CLOSES ITS CONTACT AN INTRUSION ALARM *
159 * IS DETECTED WHICH WILL ENERGIZE THE INTRUSION *
160 * ALARM RELAY OUTPUT 204. *
161 * *
162 * TOXIC GAS ALARM: OUTPUT 205 *
163 * IF INPUT 0 OPENS ITS CONTACT A TOXIC GAS ALARM *
164 * DETECTED WHICH WILL ENERGIZE THE TOXIC GAS ALARM *
165 * RELAY OUTPUT 205. *
166 * *
167 * HIGH TEMPERATURE ALARM: OUTPUT 202 *
168 * IF THE TEMPERATURE BEING READ AND STORED IN *
169 * D.R. 812 RISES ABOVE THE HIGH TEMPERATURE ALARM *
170 * SETPOINT STORED IN D.R. 842 THEN OUTPUT 202 WILL *
171 * ENERGIZE. THE A/Cs WILL ALSO BE STARTED. *

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172 * WHEN THE TEMPERATURE DROPS BELOW THE HIGH *
173 * TEMPERATURE ALARM SUBTRACTION SETPOINT IN D.R. *
174 * 843 THEN THE HIGH TEMPERATURE ALARM WILL GO OFF. *
175 * THE OFF SETPOINT IS CALCULATED BY SUBTRACTING *
176 * THE HYSTERISIS VALUE STORED IN D.R. 833 FROM THE *
177 * HIGH TEMPERATURE ALARM ON SETPOINT STORED IN *
178 * D.R. 842 AND THE RESULT IS STORED IN D.R. 843. *
179 * D.R. 843 CAN BE MONITORED BUT THE VALUE CAN *
180 * ONLY BE CHANGED BY CHANGING D.R. 833. *
181 * *
182 * HIGH HUMIDITY ALARM: OUTPUT 203 *
183 * IF THE HUMIDITY BEING READ AND STORED IN *
184 * D.R. 851 RISES ABOVE THE HIGH HUMIDITY ALARM *
185 * SETPOINT STORED IN D.R. 870 THEN OUTPUT 203 WILL *
186 * ENERGIZE. THE A/Cs WILL ALSO BE STARTED. *
187 * WHEN THE HUMIDITY DROPS BELOW THE HIGH *
188 * HUMIDITY ALARM SUBTRACTION SETPOINT IN D.R. *
189 * 871 THEN THE HIGH HUMIDITY ALARM WILL GO OFF. *
190 * THE OFF SETPOINT IS CALCULATED BY SUBTRACTING *
191 * THE HYSTERISIS VALUE STORED IN D.R. 872 FROM THE *
192 * HIGH HUMIDITY ALARM ON SETPOINT STORED IN *
193 * D.R. 870 AND THE RESULT IS STORED IN D.R. 871. *
194 * D.R. 871 CAN BE MONITORED BUT THE VALUE CAN *
195 * ONLY BE CHANGED BY CHANGING D.R. 872. *
196 * *
197 * SMOKE ALARM: OUTPUT 207 *
198 * IF INPUT 0 CLOSES ITS CONTACT A SMOKE ALARM IS *
199 * DETECTED WHICH WILL DEENERGIZE THE SMOKE ALARM *
200 * RELAY OUTPUT 207. ALL HVAC FUNCTIONS ARE *
201 * COMPLETELY DISABLED IN THE EVENT A SMOKE ALARM *
202 * IS DETECTED. *
203 * *
204 * +++++ *
205 * END OF THE SEQUENCE OF OPERATION *
206 * +++++ *
207 * *
208 * INTERNAL RELAYS 400 TO 497 ARE FOR THE EXECUTION *
209 * OF THE VAULT RELAY LADDER LOGIC PROGRAM *
210 * INCLUDING ALARM MONITORING AND REPORTING. *
211 * I.R. 500 TO 597 ARE FOR TEMPERATURE CONTROL. *
212 * I.R. 600 TO 697 ARE FOR HUMIDITY CONTROL. *
213 * *
214 * COUNTERS ARE USED AS TIMERS THROUGHOUT THE *
215 * PROGRAM TO PROVIDE 1.0 SECOND RESOLUTION AND *
216 * EASE OF PROGRAM CHANGES. TIMERS 0 TO 79 FEATURE *
217 * 0.1 SECOND RESOLUTION. FOR EXAMPLE, A TIMER WITH *
218 * A PRESET VALUE OF 400 EQUALS 40.0 SECONDS. A *
219 * PRESET OF 5 EQUALS .5 SECONDS. *
220 * *
221 * INPUT DESCRIPTION N.O/N.C. *
222 * ===== *
223 * MODULE: #1: PFJ-N162U - 16 POINT 24VDC INPUT *
224 * 0 TOXIC GAS ALARM N.C. *
225 * (CONTACT OPENS DURING GAS ALARM) *
226 * 1 EXPLOSIVE GAS ALARM N.C. *
227 * (CONTACT OPENS DURING GAS ALARM) *
228 * 2 HIGH HIGH WATER FLOAT SWITCH N.O. *

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229      *           ALARM                               *
230      *           (CONTACT CLOSURES FROM HIGH HIGH WATER) *
231      * 3         SUMP ON - HIGH WATER FLOAT SW. N.O.   *
232      *           (CONTACT CLOSURES FROM HIGH WATER)   *
233      * 4         SUMP OFF - LOW WATER FLOAT SW. N.O.  *
234      *           (CONTACT CLOSURES AS SUMP WATER BEGINS *
235      *           TO RISE - CONTACT OPENS WITH NO WATER  *
236      *           IN THE SUMP)                          *
237      * 5         DOOR INTRUSION SWITCH                N.C. *
238      *           (CONTACT CLOSURES WHEN THE DOOR IS OPEN) *
239      * 6         DOOR SWITCH                          N.C. *
240      *           (CONTACT CLOSURES WHEN THE DOOR IS OPEN) *
241      * 7         MANUAL LIGHTS PUSHBUTTON            N.O. *
242      * 10        VENT ALARM - DUCT SAIL SWITCH        N.O. *
243      *           (CONTACT CLOSURES WHEN BLOWER IS RUNNING) *
244      * 11        COMFORT CONTROL PUSHBUTTON          N.O. *
245      * 12        SMOKE DETECTOR                     N.O. *
246      *           (CONTACT CLOSURES DURING SMOKE ALARM) *
247      * 13        APPENDAGE THERMOSTAT               N.C. *
248      *           (CONTACT OPENS ON TEMPERATURE RISE  *
249      *           ABOVE 85 DEGREES)                   *
250      * 14        SPARE INPUT                         *
251      * 15        SPARE INPUT                         *
252      * 16        BAUD RATE PUSHBUTTON                N.O. *
253      * 17        BAUD RATE INPUT FROM OUTPUT 210 N.C. *
254      *           (OUTPUT 210 KEEPS INPUT 17 ON EXCEPT *
255      *           WHEN THE BAUD RATE P.B. IS PRESSED)  *
256      * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
257      * MODULE #3: PFJ-N013AU - 4 TO 20 mA ANALOG INPUT *
258      * 20-27    ANALOG INPUT - TEMPERATURE & HUMIDITY *
259      * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
260      * MODULE #5: PFJ-PU2U - 24VDC, 0.5 AMP POWER    *
261      * SUPPLY                                         *
262      * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
263      * OUTPUT DESCRIPTION                            *
264      * ===== ===== *
265      * MODULE #2: PFJ-T081U - 8 POINT RELAY OUTPUT  *
266      * 200      EXPLOSIVE GAS ALARM - RELAY CLOSURE  *
267      * 201      SUMP ALARM - RELAY CLOSURE          *
268      * 202      HIGH TEMPERATURE ALARM - RELAY CLOSURE *
269      * 203      HIGH HUMIDITY ALARM - RELAY CLOSURE  *
270      * 204      INTRUSION ALARM - RELAY CLOSURE    *
271      * 205      TOXIC GAS ALARM - RELAY CLOSURE    *
272      * 206      VENT ALARM - RELAY CLOSURE          *
273      * 207      SMOKE ALARM - RELAY CLOSURE        *
274      * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
275      * MODULE #4: PFJ-T081U - 8 POINT RELAY OUTPUT  *
276      * 210      BAUD RATE CHANGE TO INPUT 17        *
277      * 211      AIR CONDITIONER #2                 *
278      * 212      AIR CONDITIONER #1                 *
279      * 213      BLOWER                              *
280      * 214      DEHUMIDIFIER                       *
281      * 215      HEATER                              *
282      * 216      SUMP PUMP                           *
283      * 217      FLUORESCENT LIGHTS                 *
284      * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
285      * MODULE #6: PFJ-T081U - 8 POINT RELAY OUTPUT *

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286 * 220 EMERGENCY LIGHTS *
287 * 221 PLC DIAGNOSTIC OUTPUT *
288 * 222 RED "WARNING" HATCHWAY PILOT LIGHT *
289 * 223 GREEN "SAFE" HATCHWAY PILOT LIGHT *
290 * 224 VENT ALARM BUZZER *
291 * 225 COMFORT CONTROL ILLUMINATED P.B. *
292 * 226 INDOOR HUMIDITY ANALOG MULTIPLEX *
293 * 227 INDOOR TEMPERATURE ANALOG MULTIPLEX *
294 *
295 * PHANTOM INPUTS (FORCED ON USING PROGRAM LOADER) *
296 * 100 TO ENABLE OUTPUT FORCING FEATURE FOR *
297 * 1 HOUR PRESS: *
298 * TRS SET 100 ENTER *
299 * TO FORCE ON AN INDIVIDUAL OUTPUT ADD 100 *
300 * TO THE OUTPUT NUMBER SHOWN IN THE LIST *
301 * ABOVE AND USE THE FOLLOWING PROGRAM *
302 * LOADER KEYSTROKES: *
303 * TRS SET 307 ENTER *
304 * THIS WOULD FORCE ON OUTPUT 207. TO *
305 * FORCE ON OTHER OUTPUTS SUBSTITUTE THE *
306 * 307 VALUE FOR ANOTHER NUMBER FROM 300 *
307 * TO 325 THAT CORRESPONDS TO THE SPECIFIC *
308 * OUTPUT THAT IS TO BE FORCED ON. *
309 * TO RESET THE OUTPUT FORCING FOR AN *
310 * INDIVIDUAL OUTPUT SUBSTITUTE THE "SET" *
311 * COMMAND WITH THE "RST" COMMAND. FOR *
312 * EXAMPLE, TO DISABLE OUTPUT FORCING FOR *
313 * OUTPUT 207 (SMOKE ALARM) PRESS: *
314 * TRS RST 307 ENTER *
315 * 101 TO RESET THE OUTPUT FORCING FEATURE *
316 * FOR ALL OF THE OUTPUTS PRESS: *
317 * TRS SET 101 ENTER *
318 * 120 TO RESTORE THE TEMPERATURE AND HUMIDITY *
319 * SETPOINTS TO THE INITIAL PROGRAM DEFAULT *
320 * VALUES PRESS: *
321 * TRS SET 120 ENTER *
322 *
323 * TEMPERATURE AND HUMIDITY DATA REGISTER LOCATIONS *
324 * DATA *
325 * REG. *
326 * NBR. SETTING DESCRIPTION *
327 * ===== *
328 * PROGRAM VERSION DATE: *
329 * 802 1998 YEAR *
330 * 803 10 MONTH *
331 * 804 14 DAY *
332 *
333 * DATA LOGGING TEMP & HUMIDITY ELAPSED TIME: *
334 * 805 N/A MINUTES SINCE LAST READING *
335 * 806 N/A HOURS SINCE LAST READING *
336 *
337 * NUMERIC PROGRAM NAME ASSIGNMENT: *
338 * 807 9200 9600 BAUD, CEV, CEV24 PROGRAM *
339 *
340 * TEMPERATURE: *
341 * 808 0 TEMPERATURE CALIBRATION ADDITION *
342 * SETPOINT. THIS VALUE IS ADDED *

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343	*			TO THE MEASURED TEMPERATURE IN	*
344	*			D.R. 811 (D 11) TO COMPENSATE	*
345	*			FOR SMALL DIFFERENCES IN THE	*
346	*			ACTUAL TEMPERATURE.	*
347	*	809	0	TEMPERATURE CALIBRATION	*
348	*			SUBTRACTION SETPOINT. THIS	*
349	*			VALUE IS SUBTRACTED FROM THE	*
350	*			MEASURED TEMPERATURE IN D.R. 811	*
351	*			(D 11) TO COMPENSATE FOR SMALL	*
352	*			DIFFERENCES IN THE ACTUAL	*
353	*			TEMPERATURE.	*
354	*	810	N/A	ANALOG INPUT OF INDOOR	*
355	*			TEMPERATURE IN BINARY (0 TO 255)	*
356	*	811	N/A	MEASURED INDOOR TEMPERATURE FROM	*
357	*			THE TEMPERATURE SENSOR. THIS	*
358	*			VALUE MAY BE SLIGHTLY ADJUSTED	*
359	*			UP OR DOWN USING D.R. 808 (D 8)	*
360	*			& 809 (D 9) TO COMPENSATE FOR	*
361	*			ANY TEMPERATURE SENSOR	*
362	*			CALIBRATION PROBLEMS.	*
363	*	812	C*	INDOOR TEMPERATURE - D.R. 811	*
364	*			(D 11) PLUS D.R. 808 (D 8) MINUS	*
365	*			D.R. 809 (D 9).	*
366	*	813	62	HEAT ON	*
367	*	814	68	HEAT ON - COMFORT CONTROL	*
368	*	815	C* 831	HEAT OFF (D.R. 813 PLUS D.R.	*
369	*			831)	*
370	*	816	C* 832	HEAT OFF - COMFORT CONTROL	*
371	*			(D.R. 814 PLUS D.R. 832)	*
372	*	817	80	A/C ON	*
373	*	818	72	A/C ON - COMFORT CONTROL	*
374	*	819	C* 834	A/C OFF (D.R. 817 MINUS D.R.	*
375	*			834)	*
376	*	820	C* 835	A/C OFF - COMFORT CONTROL	*
377	*			(D.R. 818 MINUS D.R. 835)	*
378	*	825	74	BLOWER ON - WHEN VAULT TEMP IS	*
379	*			GREATER THAN THE SETPOINT AND	*
380	*			THERE IS NO HIGH HUMIDITY	*
381	*	827	C* 830	BLOWER OFF - LOW TEMP (D.R. 825	*
382	*			MINUS D.R. 830)	*
383	*	830	2	BLOWER OFF SUBTRACTION SETPOINT	*
384	*			(SUBTRACTED FROM D.R. 825)	*
385	*	831	5	HEAT OFF ADDITION SETPOINT	*
386	*			(ADDED TO D.R. 813)	*
387	*	832	1	HEAT OFF - COMFORT CONTROL	*
388	*			ADDITION SETPOINT	*
389	*			(ADDED TO D.R. 814)	*
390	*	833	7	HIGH TEMPERATURE ALARM OFF	*
391	*			SUBTRACTION SETPOINT	*
392	*			(SUBTRACTED FROM D.R. 842)	*
393	*	834	5	A/C OFF SUBTRACTION SETPOINT	*
394	*			(SUBTRACTED FROM D.R. 817)	*
395	*	835	2	A/C OFF - COMFORT CONTROL	*
396	*			SUBTRACTION SETPOINT	*
397	*			(SUBTRACTED FROM D.R. 818)	*
398	*	837	65	DISABLE THE A/C DURING A HIGH	*
399	*			HUMIDITY ALARM CONDITION IF THE	*

400	*		TEMPERATURE DROPS BELOW THIS	*
401	*		SETPOINT. THE HEAT WILL	*
402	*		ENERGIZE IF A HIGH HUMIDITY	*
403	*		ALARM OCCURS AND THE TEMPERATURE	*
404	*		IS BELOW THIS SETPOINT.	*
405	*	842 95	HIGH TEMPERATURE ALARM ON	*
406	*	843 C* 833	HIGH TEMPERATURE ALARM OFF	*
407	*		(D.R. 842 MINUS D.R. 833)	*
408	*			*
409	*			*
410	*		HUMIDITY:	*
411	*	850 N/A	ANALOG INPUT OF INDOOR HUMIDITY	*
412	*		IN BINARY (0 TO 255)	*
413	*	851 C*	PERCENT OF INDOOR RELATIVE	*
414	*		HUMIDITY - D.R. 852 (D 52) PLUS	*
415	*		D.R. 853 (D 53) MINUS D.R. 854	*
416	*		(D 54)	*
417	*	852 N/A	MEASURED INDOOR HUMIDITY FROM	*
418	*		THE HUMIDITY SENSOR. THIS VALUE	*
419	*		MAY BE SLIGHTLY ADJUSTED UP OR	*
420	*		DOWN USING D.R. 853 (D 53) & 854	*
421	*		(D 54) TO COMPENSATE FOR ANY	*
422	*		HUMIDITY SENSOR CALIBRATION	*
423	*		PROBLEMS.	*
424	*	853 0	HUMIDITY CALIBRATION ADDITION	*
425	*		SETPOINT. THIS VALUE IS ADDED	*
426	*		TO THE MEASURED HUMIDITY IN D.R.	*
427	*		852 (D 52) TO COMPENSATE FOR	*
428	*		SMALL DIFFERENCES IN THE ACTUAL	*
429	*		HUMIDITY	*
430	*	854 0	HUMIDITY CALIBRATION SUBTRACTION	*
431	*		SETPOINT. THIS VALUE IS	*
432	*		SUBTRACTED FROM THE MEASURED	*
433	*		HUMIDITY IN D.R. 852 (D 52) TO	*
434	*		COMPENSATE FOR SMALL DIFFERENCES	*
435	*		IN THE ACTUAL HUMIDITY.	*
436	*	862 55	DEHUMIDIFIER ON	*
437	*	863 C* 881	DEHUMIDIFIER OFF (D.R. 862	*
438	*		MINUS D.R. 881)	*
439	*	865 70	BLOWER ENABLED TO BE CONTROLLED	*
440	*		BY TEMPERATURE WHEN HUMIDITY IS	*
441	*		LESS THAN SETPOINT	*
442	*	866 C* 880	BLOWER IS DISABLED FROM CONTROL	*
443	*		BY TEMPERATURE WHEN THE	*
444	*		HUMIDITY IS GREATER THAN THE	*
445	*		SETPOINT	*
446	*		(D.R. 865 PLUS D.R. 880)	*
447	*	870 85	HIGH HUMIDITY ALARM ON	*
448	*	871 C* 882	HIGH HUMIDITY ALARM OFF (D.R.	*
449	*		870 MINUS D.R. 882)	*
450	*	880 5	BLOWER DISABLED OFF ADDITION	*
451	*		SETPOINT	*
452	*		(ADDED TO D.R. 865)	*
453	*	881 5	DEHUMIDIFIER OFF SUBTRACTION	*
454	*		SETPOINT	*
455	*		(SUBTRACTED FROM D.R. 862)	*
456	*	882 5	HIGH HUMIDITY ALARM OFF	*

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457      *              SUBTRACTION SETPOINT              *
458      *              (SUBTRACTED FROM D.R. 870)         *
459      *
460      * * NOTE: A "C" IN THE SETTING COLUMN INDICATES *
461      *              THAT THE DATA REGISTER IS CALCULATED BY *
462      *              ADDING OR SUBTRACTING A "DEADBAND" VALUE *
463      *              FROM THE ON SETTING FOR LOADS AND ALARMS *
464      *
465      * DATA LOGGING:
466      * 1500-1589      TEMPERATURE RECORDINGS FOR THE *
467      *              PREVIOUS 30 DAYS                   *
468      * 1600-1689      HUMIDITY RECORDINGS FOR THE *
469      *              PREVIOUS 30 DAYS                   *
470      *
471      *
472      * ELAPSED HOURS OF OPERATION METERS:
473      * 1701          A/C #1 0-9999 HOURS              *
474      * 1702          A/C #1 10,000-99,990,000 HOURS *
475      *
476      * 1704          A/C #2 0-9999 HOURS              *
477      * 1705          A/C #2 10,000-99,990,000 HOURS *
478      *
479      * 1713          BLOWER 0-9999 HOURS              *
480      * 1714          BLOWER 10,000-99,990,000 HOURS *
481      *
482      * 1716          SUMP PUMP 0-9999 HOURS            *
483      * 1717          SUMP PUMP 10,000-99,990,000 HOUR *
484      *
485      * 1719          DEHUMIDIFIER 0-9999 HOURS        *
486      * 1720          DEHUMID. 10,000-99,990,000 HOURS *
487      *
488      * 1722          HEATER 0-9999 HOURS              *
489      * 1723          HEATER 10,000-99,990,000 HOURS *
490      *
491      * 1728          COMFORT CONTROL 0-9999 HOURS     *
492      * 1729          C.C. 10,000-99,990,000 HOURS   *
493      *
494      * 1737          PLC IN THE RUN MODE 0-9999 HOURS *
495      * 1738          PLC IN THE RUN MODE 10,000 TO *
496      *              99,990,000 HOURS                 *
497      *
498      *
499      *      PLC DIAGNOSTICS DATA REGISTER BINARY STORAGE *
500      * DATA      BINARY
501      * REGISTER  VALUE  DESCRIPTION
502      * =====  =====
503      * 1770      1      INDOOR TEMP. SENSOR FAILURE *
504      * 1771      2      INDOOR HUMIDITY SENSOR FAILURE *
505      * 1789      N/A     TOTAL OF ALL DIAGNOSTIC ERRORS *
506      *              DETECTED
507      *
508      *
509      * TO CHANGE THE DATA REGISTER SETPOINTS PRESS *
510      * THE FOLLOWING KEYS ON THE HAND HELD LOADER OR *
511      * USE THE HYLAND AUTOMATION CONTROLS, INC. OI-2000 *
512      * GRAPHIC COMMUNICATION SOFTWARE PACKAGE:
513      *              TRS 813 READ

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514      *                64 ENTER                *
515      * THIS WOULD CHANGE D.R. 813 (HEAT ON) FROM 62 *
516      * DEGREES TO 64 DEGREES                *
517      * * * * * * * * * * * * * * * * * * * * *
518      * TO MONITOR DATA REGISTER 812 PRESS: *
519      *                MON 812 READ            *
520      * THE VALUE SHOWN ON THE RIGHT SIDE OF THE PROGRAM *
521      * LOADER DISPLAY IS THE PRESENT TEMPERATURE OF *
522      * THE CEV. * * * * * * * * * * * * * * * * *
523      * * * * * * * * * * * * * * * * * * * * *
524      * ALARM MONITORING COUNTERS: *
525      * COUNTER * * * * * * * * * * * * * * * * *
526      * NUMBER DESCRIPTION * * * * * * * * * * *
527      * ===== * * * * * * * * * * * * * * * *
528      * 3 EXPLOSIVE GAS ALARM * * * * * * * * * * *
529      * 4 TOXIC GAS ALARM * * * * * * * * * * *
530      * 5 SUMP ALARM * * * * * * * * * * *
531      * 7 HIGH TEMPERATURE ALARM * * * * * * * * *
532      * 8 HIGH HUMIDITY ALARM * * * * * * * * *
533      * 9 SMOKE ALARM * * * * * * * * * * *
534      * 10 INTRUSION ALARM * * * * * * * * * * *
535      * 11 VENT ALARM * * * * * * * * * * *
536      * * * * * * * * * * * * * * * * * * * * *
537      * TO MONITOR THE QUANTITY OF EXPLOSIVE GAS ALARMS *
538      * PRESS: * * * * * * * * * * * * * * * * *
539      *                MON CNT 3 READ * * * * * * * *
540      * TO CONTINUE READING THE NEXT COUNTER NUMBER *
541      * PRESS: * * * * * * * * * * * * * * * * *
542      *                READ * * * * * * * * * * *
543      * * * * * * * * * * * * * * * * * * * * *
544      * * * * * * * * * * * * * * * * * * * * *
545      * COMMONLY USED PROGRAM LOADER/PROM BURNER *
546      * INSTRUCTIONS * * * * * * * * * * * * * *
547      * * * * * * * * * * * * * * * * * * * * *
548      *                PLC PROGRAM UPLOAD/DOWNLOAD *
549      *                ===== * * * * * * * * * *
550      * DESCRIPTION OF OPERATION LOADER KEYSTROKES *
551      * ===== * * * * * * * * * * * * * * * *
552      * UPLOAD FROM CPU TO LOADER TRS READ ENTER *
553      * * * * * * * * * * * * * * * * * * * * *
554      * TO VERIFY A PROGRAM TRANSFER * * * * * * * *
555      * TO A RAM MEMORY PACK * * * * * * * * * * *
556      * (NOT A EEPROM MEMORY PACK) TRS VERI ENTER *
557      * * * * * * * * * * * * * * * * * * * * *
558      * DOWNLOAD FROM LOADER TO RAM * * * * * * * *
559      * TYPE MEMORY PACK (NOT EEPROM) TRS ENTER ENTER *
560      * * * * * * * * * * * * * * * * * * * * *
561      * CHANGE PLC TO PROGRAM MODE * * * * * * * *
562      * (NOT IN "RUN" MODE) TRS SET 701 ENTER *
563      * * * * * * * * * * * * * * * * * * * * *
564      * IF CPU RUN LIGHT IS STILL ON TRS RST 702 ENTER *
565      * * * * * * * * * * * * * * * * * * * * *
566      * CHANGE PLC FROM PROGRAM MODE * * * * * * * *
567      * TO RUN MODE TRS RST 701 ENTER *
568      * * * * * * * * * * * * * * * * * * * * *
569      * TO ERASE THE LOADER MEMORY DELT END ENTER *
570      * +++++ * * * * * * * * * * * * * * * * *

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571          *                PLC MONITORING                *
572          *                =====                *
573          * TO MONITOR INPUTS 0 TO 7          MON 0 READ    *
574          *                *                *                *
575          * TO MONITOR OUTPUTS 200 TO 207    MON 200 READ    *
576          *                *                *                *
577          * TO MONITOR TIMER #10              MON TIM 10 READ *
578          *                *                *                *
579          * TO MONITOR COUNTER #3             MON CNT 3 READ  *
580          *                *                *                *
581          * TO MONITOR DATA REGISTER 812     MON 812 READ    *
582          *                *                *                *
583          * TO MONITOR THE PLC SCAN TIME      *                *
584          * (VALUE SHOWN IS IN              *                *
585          * MILLISECONDS)                     MON CNT 47 READ *
586          *                *                *                *
587          * TO MONITOR THE NEXT CPU           *                *
588          * CONSECUTIVE ADDRESS PRESS        READ          *
589          *                *                *                *
590          * TO MONITOR THE PREVIOUS CPU      *                *
591          * CONSECUTIVE ADDRESS PRESS        VERI          *
592          * ++++++*                *                *
593          *          CHANGING TIMERS/COUNTERS/DATA REGISTERS *
594          *          =====                *
595          * TO CHANGE PRESET ON TIMER 20      TRS TIM 20 READ *
596          * THEN PRESS KEYS FOR NEW          *                *
597          * NUMERIC VALUE AND PRESS ENTER    *                *
598          *                *                *                *
599          * TO CHANGE PRESET ON COUNTER 2    TRS CNT 2 READ  *
600          * THEN PRESS KEYS FOR NEW          *                *
601          * NUMERIC VALUE AND PRESS ENTER    *                *
602          *                *                *                *
603          * TO CHANGE PRESET STORED IN      *                *
604          * DATA REGISTER 813              TRS 813 READ    *
605          * THEN PRESS KEYS FOR NEW          *                *
606          * NUMERIC VALUE AND PRESS ENTER    *                *
607          * ++++++*                *                *
608          *          PROM READING AND PROM BURNING          *
609          *          =====                *
610          * NOTE: NEVER INSERT OR REMOVE AN EEPROM MEMORY *
611          *          PACK WHEN THE PROGRAM LOADER/PROM BURNER *
612          *          IS POWERED              *                *
613          * TO READ AN EEPROM/EPROM INTO    *                *
614          * THE LOADER'S MEMORY              PROM READ ENTER *
615          *                *                *                *
616          * TO VERIFY AN EEPROM/EPROM        *                *
617          * MATCHES THE PLC PROGRAM          *                *
618          * IN THE LOADER                    PROM VERI ENTER *
619          *                *                *                *
620          * TO BURN AN EEPROM MEMORY PACK    PROM ENTER ENTER *
621          * ++++++*                *                *
622          *          MISCELLANEOUS INSTRUCTIONS          *
623          *          =====                *
624          * TO CLEAR THE LCD DISPLAY          CLR            *
625          *                *                *                *
626          * TO ADDRESS 0 (THE START OF      *                *
627          * THE PLC PROGRAM)                 CLR CLR CLR    *

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628 *
629 * TO THE END OF THE PLC PROGRAM END READ *
630 *
631 * SPARE WORDS LEFT IN THE *
632 * PLC PROGRAM ADRS READ *
633 *
634 * TO ACCESS A SPECIFIC ADDRESS *
635 * ie. GO TO ADDRESS 1024 ADRS 1024 READ *
636 *
637 * SEARCH FOR OUTPUT 212 IN THE *
638 * PLC PROGRAM OUT 212 READ *
639 *
640 * NOTE: THE LAST TWO INSTRUCTIONS CAN BE DONE *
641 * FROM THE BEGINNING OF THE PLC PROGRAM. *
642 * TO BE SURE YOU ARE AT THE BEGINNING *
643 * PRESS CLR 3 TIMES. *
644 * ++++++ *
645 * OUTPUT FORCING *
646 * ===== *
647 * TO ACTIVATE OUTPUT FORCING TRS SET 100 ENTER *
648 * FIND THE OUTPUT NUMBER (200 *
649 * TO 297) OF THE PLC OUTPUT *
650 * THAT YOU WANT TO FORCE ON *
651 * AND ADD 100 TO IT. *
652 * ie. TO FORCE ON OUTPUT 213 TRS SET 313 ENTER *
653 *
654 * TO REMOVE OUTPUT FORING *
655 * FROM INDIVIDUAL LOADS REPLACE *
656 * THE "SET" COMMAND WITH THE *
657 * "RST" INSTRUCTION. *
658 * ie. TO TURN OFF OUTPUT *
659 * FORCING FOR OUTPUT 213 TRS RST 313 ENTER *
660 *
661 * TO DEACTIVATE THE OUTPUT *
662 * FORCING FOR ALL OUTPUTS TRS SET 101 ENTER *
663 * ++++++ *
664 * RESTORE TEMPERATURE/HUMIDITY FACTORY SETPOINTS *
665 * ===== *
666 * TO RESTORE TEMP. AND HUMIDITY *
667 * FACTORY SETPOINTS TRS SET 120 ENTER *
668 * ++++++ *
669 * RESET ALARM COUNTERS *
670 * ===== *
671 * ALARM COUNTER LOADER KEYSTROKES *
672 * ===== *
673 * EXPLOSIVE GAS ALARM TRS SET 130 ENTER *
674 * TOXIC GAS ALARM TRS SET 131 ENTER *
675 * SUMP ALARM TRS SET 132 ENTER *
676 * HIGH TEMPERATURE ALARM TRS SET 134 ENTER *
677 * HIGH HUMIDITY ALARM TRS SET 135 ENTER *
678 * SMOKE ALARM TRS SET 136 ENTER *
679 * INTRUSION ALARM TRS SET 137 ENTER *
680 * VENT ALARM TRS SET 140 ENTER *
681 *
682 * MASTER RESET FOR ALL ALARM *
683 * COUNTERS TRS SET 110 ENTER *
684 * ++++++ *

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742 * AND HUMIDITY WITH THE IDEC HAND HELD LOADER. *
743 * TEMPERATURE: MON 812 READ *
744 * HUMIDITY: MON 851 READ *
745 * THE TEMPERATURE SHOULD RISE AND HUMIDITY *
746 * SHOULD FALL (DRY HEAT). *
747 * NOTE: DO NOT LOCATE A STRONG HEAT SOURCE *
748 * SUCH AS A CIGARETTE LIGHTER OR MATCH *
749 * TO CLOSE TO THE SENSOR - IT CAN BE *
750 * DAMAGED *
751 * REPLACE THE OMEGA ENGINEERING TEMPERATURE / *
752 * HUMIDITY SENSOR IF THERE IS NO RESPONSE. *
753 * *
754 * FUN TABLE: *
755 * FUN *
756 * NBR. SETTING DESCRIPTION *
757 * ===== *
758 * 1 4 4K OF USER MEMORY *
759 * 6 401 I.R. 400 RETAINS IT'S ON/OFF *
760 * STATUS DURING A POWER FAILURE *
761 * 7 20 CNT 0 TO 19 RETAIN THEIR COUNT *
762 * VALUE DURING A POWER FAILURE *
763 * 38 96081 COMMUNICATION PARAMETERS: *
764 * 9600 BAUD, NO PARITY, 8 DATA *
765 * BITS, AND 1 STOP BIT *
766 * 39 17 CHANGES BAUD RATE TO 9600 BAUD *
767 * NO PARITY WHEN INPUT 17 IS ON *
768 * 61 500 PLC IN AUTO RUN MODE *
769 * *
770 * OMEGA ENGINEERING HX93C TEMPERATURE & HUMIDITY *
771 * SENSOR CONNECTIONS: *
772 * OMEGA ENGR. SENSOR: *
773 * TERMINAL *
774 * NUMBER CONNECT TO: *
775 * ===== *
776 * 1 OUTPUT 226A (BOTTOM CONNECTION) *
777 * 2 24VDC POSITIVE *
778 * 3 OUTPUT 227A (BOTTOM CONNECTION) *
779 * 4 24VDC POSITIVE *
780 * *
781 * OUTPUT *
782 * NUMBER CONNECT TO: *
783 * ===== *
784 * 226 ANALOG INPUT MODULE 4-20mA POSITIVE *
785 * 227 ANALOG INPUT MODULE 4-20mA POSITIVE *
786 * NOTE: THE TOP SIDE TERMINALS ON *
787 * OUTPUTS 226 AND 227 ARE JUMPED *
788 * TOGETHER AND A SINGLE WIRE IS THEN *
789 * CONNECTED TO THE ANALOG INPUT *
790 * MODULE'S 4-20mA ANALOG INPUT *
791 * TERMINALS ON THE MIDDLE OF THE *
792 * MODULE'S TERMINAL STRIP *
793 * *
794 * ANALOG *
795 * INPUT *
796 * MODULE CONNECT TO: *
797 * ===== *
798 * 4-20mA NEGATIVE 24VDC NEGATIVE *

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799      *
800      * PLC PROGRAM LAYOUT:
801      * SECTION
802      * NUMBER      DESCRIPTION
803      * =====
804      * 1          PROGRAM HEADER
805      * 2          LOGIC SECTION CONTROL OF LOADS &
806      *           ALARMS
807      * 3          INDOOR TEMP. CONVERSION & COMPARISONS
808      * 4          INDOOR HUMID. CONVERSION & COMPARISONS
809      * 5          DATA LOGGING & DIAGNOSTICS
810      * 6          MISCELLANEOUS
811      * 7          PLC OUTPUTS
812      *
813      * INTERNAL RELAY ALLOCATION TABLE:
814      * 400-406    MISCELLANEOUS SYSTEM CONTROL LOGIC
815      * 407-417    SYSTEM FEATURES
816      * 420-447    ENTRY, EXIT, AND LIGHTING CONTROL
817      *           LOGIC
818      * 450-457    SPARE
819      * 460-467    VENT ALARM, BLOWER, SUMP, & GAS ALARM
820      *           CONTROL LOGIC
821      * 470-487    A/C SEQUENCING & START DELAY CONTROL
822      * 490-497    HEATER CONTROL LOGIC
823      * 500-597    TEMPERATURE CONTROL COMPARISONS AND
824      *           CONTROL LOGIC
825      * 600-697    HUMIDITY CONTROL COMPARISONS AND
826      *           CONTROL LOGIC
827      * 2200-2297  CEV PROGRAM VERSION
828      * 2300-2357  SPARE
829      * 2400-2497  HUT PROGRAM VERSION
830      * 2500-2597  ELAPSED HOURS OF OPERATION CONTROL
831      *           LOGIC
832      * 2600-2667  PROGRAM MONITORING RELAYS FOR OI-2000
833      *           MODEM GRAPHIC SOFTWARE PACKAGE
834      * 2670-2697  PLC DIAGNOSTIC SECTION
835      * 2700-2717  SPARE
836      *
837      * =====
838      *           PLC PROGRAM
839      * =====
840      *
841      * SECTION #1:
842      *           PROGRAM HEADER
843      *
844      *
845      * I.R. 2200 IS USED FOR A 24 FOOT CEV WITH 2 A/C
846      * UNITS, AND 1 HEATER.
847      *
      PLC
      IS IN
      RUN
      MODE
      717
      24 'CEV
      PROGRM
      VERSIN
      2 A/Cs
      (
      2200
      )
849      *

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850 | *          PROGRAM VERSION DATE STORAGE          *
851 | * EVERY TIME A CHANGE IN THE PROGRAM IS MADE THESE *
852 | * DATA REGISTERS MUST BE UPDATED TO STORE THE NEW *
853 | * PROGRAM DATE VALUES                             *
854 | *                                                  *
855 | *                                                  *
856 | * THE YEAR IS STORED IN DR 802                    *
857 | * THE MONTH IS STORED IN DR 803                   *
858 | * THE DAY IS STORED IN DR 804                     *
859 | * THE PROGRAM NAME ASSIGNMENT IS STORED IN DR 807 *
860 | *                                                  *
      | PLC          VERSIN
      | IS IN        YEAR
      | RUN         SET-
      | MODE       TING
861 | +---+-----+ [F 147]-[F 247]-[F 147]+
      | 717          220   1998   802
      |
      |          VERSIN
      |          MONTH
      |          SET-
      |          TING
862 | + [F 147]-[F 247]-[F 147]+
      | 220      10    803
      |
      |          VERSIN
      |          DAY
      |          SET-
      |          TING
863 | + [F 147]-[F 247]-[F 147]+
      | 220      14    804
      |
      |          PROGRM
      |          NAME
      |          D.R.
      |          ASSIGN
864 | + [F 147]-[F 247]-[F 147]+
      | 220      9200   807

```