

**USING THE CR10KD KEYPAD TO TROUBLESHOOT AND/OR
RESET THE CAMPBELL SCIENTIFIC RAIN BIRD WEATHER
STATION
BART NEF – CSI
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The CR10KD keypad is used to directly access the weather station datalogger. See the attached prompt sheet for more information on moving around in each of these modes.

NOTE: THE KEYPAD IS LOW MAN ON THE COMMUNICATION TOTEM POLE AND ANY OTHER ACTIVE COMMUNICATION WILL CAUSE THE DATALOGGER TO DISABLE THE KEYPAD. MAKE SURE THE WEATHER STATION IS NOT BEING ACCESSED VIA PHONE OR SHORT HAUL MODEM WHILE USING THE KEYPAD.

GETTING INTO KEYPAD MODE USING THE CENTRAL COMPUTER
SKIP THIS SECTION IF YOU'RE DIRECTLY ACCESSING THE STATION VIA KEYPAD.

These modes can also be accessed from the central computer by using HyperTerminal or some other terminal emulation package.

Once you've entered terminal mode press the <Enter> key several times. If the terminal emulation software is configured properly and the datalogger is listening it will send back an asterisk (*) every time the <Enter> key is pressed. The datalogger only understands capital letters – press your <Caps Lock> key to turn the capital letters on for this session.

UNLOCKING SECURITY WHILE IN HYPERTERMINAL

At the asterisk prompt key in "9635L" without the quotes and press <Enter>. The next line returned by the datalogger should start with "S00 CXXXX" Xs are some numbers that are not relevant. What is relevant are the two values that follow the letter 'S'. If you don't get two zeros following the letter 'S' then security isn't switched off.

To get the datalogger into remote keypad mode type in 7H at the asterisk and press <Enter>. The datalogger will send back a "greater than" symbol (>) to show that you're in remote keypad mode. From here on out the datalogger will respond as if you have a keypad plugged into the datalogger's serial I/O port. Using a terminal emulator will cause the datalogger to respond with different characters in some modes than when using a keypad.

DATALOGGER MODES

The datalogger has various areas where it stores information such as the weather station program, time & date, memory partitioning, etc. These areas are called MODES and can be accessed by pressing the star key (*) followed by the appropriate number or letter. Changing from mode to mode can be done at any time BUT be careful, the datalogger

will not accept changes without pressing the ‘A’ key after the change has been entered. More on this later...

Description of modes:

*0: Causes the datalogger to compile any changes in it’s program, starts logging data, and stops communication with the keypad. When in this mode the keypad will display L061.

ALWAYS USE THIS COMMAND BEFORE LEAVING THE WEATHER STATION.

If you happen to forget using this command before leaving the weather station the datalogger will think it’s still communicating with the keypad and will not communicate properly with the central computer. The datalogger will automatically reset within 40 – 45 seconds if it doesn’t hear from the keypad.

*1, *2, & *3: Datalogger Programming Modes. Don’t go into these areas unless directed to do so by someone from Campbell Scientific or if you know what the heck you’re doing. You can do some real damage in these areas.

*5: Display/Set Datalogger Date & Time – This mode is used to check on datalogger current time and set the year, Julian day (1 – 365), and present time based on a 24 hour clock.

:HH:MM:SS (displays current datalogger time)

05:XXxx Year (CR10 displays two characters, CR10X displays four characters)

05:xxxx Julian Day (1 – 365)

05:HHMM Hours Minutes

*6: Input Location Values – the datalogger “wakes up” and read sensors at a certain interval. The datalogger wakes up every 5 seconds (6 seconds with SmartWeather) and makes sensor measurements. All new measurements go to these input locations. Below is a list of input locations used with the Rain Bird weather stations.

1. Battery Voltage - volts
2. Air Temperature - Celsius
3. Relative Humidity - %RH
4. Wind Run – Kilometers/Day
5. Solar Radiation - Langley
6. Rainfall – inches (past 5 seconds)
7. Wind Direction - degrees
8. Air Temperature – Fahrenheit (Soil Temperature w/SmartWeather)
9. Relative Humidity – same as #3
10. Wind Speed - mph
11. Solar Radiation – same as #5
12. Rainfall since midnight - inches
13. *Canister Moisture or Enclosure Relative Humidity
14. Datalogger Temperature – Celsius
15. Program Signature

☛- WS100/200 use canister moisture which will be some range from 0 – 1000. Anything above 250 should indicate need to put in new desiccant packs. WS-Pro station uses a relative humidity sensor inside the enclosure that ranges from 0 – 100%. Put new desiccant in the station if it's higher than 50%. I like to use two bags of the 4-unit size desiccant bags.

NOTE: SmartWeather does NOT use all the same input locations for measurements.

*7: Final Storage Data – The datalogger stores hourly values to this area at the top of each hour. The datalogger stores data in an array that contains 16 elements per array. The datalogger can store approximately 3 months of data before it starts to overwrite the oldest array in storage. This area cannot be disturbed directly and the values can be viewed – BUT – why? Below is a listing of how the data is structured.

1. Array ID – 108
2. Julian Day (1 – 365)
3. Hour/Minute (HHMM based on a 24 hour clock)
4. Hourly Average Air Temperature – Celsius
5. Hourly Average Relative Humidity - %RH
6. Hourly Average Wind Run – kph
7. Total Solar Radiation - Langley's
8. Total Hourly Rainfall – inches
9. Maximum Air Temperature for Past Hour – Celsius
10. Hour/Minute of Maximum Air Temperature
11. Minimum Air Temperature for Past Hour – Celsius
12. Hour/Minute of Minimum Air Temperature

*A: Memory Allocation – The datalogger has a finite amount of memory that is allocated based on the program that it's running. CHANGING ANY VALUES, EVEN IF IT'S THE SAME VALUE, IN ANY OF THE PARAMETERS FOR THIS AREA WILL CAUSE THE DATALOGGER TO LOSE ALL STORED DATA!

01:xxxx	Number of input locations (default is 28)
02:xxxx	Intermediate storage locations (default is 64)
03:x	Final storage locations – Area 2
04:xxxxx	Final storage locations – Area 1
05:xxxx.x	☛Memory allocated for program (bytes)
06:xxxx.x	Remaining program memory (bytes – only used with CR10X)

☛- This area is also used to force the datalogger to reset. To reset the CR10 enter in 1986 then press the 'A' key. WARNING: RESETTING A CR10 CAUSES IT TO LOSE ALL DATA AND CLOCK SETTINGS! PROGRAM IS RELOADED FROM THE INTERNAL PROM AFTER THE DATALOGGER HAS BEEN RESET.

Powering the station down, then up again, can also reset the datalogger. DO NOT TRY TO COMMUNICATE WITH THE DATALOGGER FOR TWO OR THREE MINUTES

AFTER A RESET.

NOTE: The newer WS-PRO or older WS100/200 with a CR10X cannot be reset by powering the unit on and off. It requires a special command to perform a reset. **RESETTING THIS DATALOGGER WILL CAUSE IT TO LOSE DATA AND PROGRAM! PROGRAM MUST BE RELOADED!!!** Call me if this needs to be done.

To fully reset a CR10X datalogger go to the *A area and fifth parameter as you would for an older datalogger but key in 98765 and press ‘A’ or <Enter>. The datalogger will go off line for a full 30 – 40 seconds. Don’t try to communicate with it during this period of time. **The datalogger will have no program or data after being reset!** Special software will be needed to send the original factory program or SmartWeather can be used to send an alarm program to the station.

*B: Datalogger Status/On-Board Firmware – the datalogger tracks what firmware it’s running internally as well as any problems it might encounter.

01:xxxxx	Program Signature
02:xxxxx	Operating System Signature
03:xxxxx	①K bytes memory
04:xx	②No. of E08’s (key 88A to reset)
05:xx	②No. of table overruns (key 88A to reset)
06:x.xxxx	Operating system version number
07:xxxx	Revision number
08:x.xxxx	③Lithium battery voltage
09:xx	③Low 12V battery detect counter (key 88A to reset)

①- This represents RAM + ROM in the CR10 datalogger. This number will be 48 in the real old WS100/200 stations with old CR10 dataloggers. This number is 96 in newer CR10 stations. NOTE: IF THE NUMBER IS 99 THEN THE DATALOGGER WAS NOT POWERED UP PROPERLY AND NEEDS TO BE RESET.

WARNING: 48K DATALOGGERS WILL REQUIRE REPLACEMENT RAM MEMORY CHIPS AND JUMPER CHANGES ON THE DATALOGGER BOARD WITH WS100/200 STATIONS WITH TEMP/%RH UPGRADE.

In the CR10X datalogger this number represents Flash + SRAM and should be 0256. This datalogger is protected to power up properly and should never have a problem with incorrect memory size.

② - These values represent errors caused during datalogger program execution. Under normal conditions these values should always be 00. Maximum value for both these areas is 99. Errors recorded in these locations usually represent communication problems with the central computer or power surges caused by fluctuating AC voltage or lightning strikes.

Always reset these areas if they are anything but 00. Key in “88A” without the quotation

marks to reset the error counters back to zero .

③ - These values only appear in the CR10X

*C: Security – used to lock people out of certain areas of the datalogger. WARNING:
DON'T MESS WITH THIS AREA.

*D: Not used with Rain Bird weather stations.

CR10X PROMPT SHEET

This prompt sheet is intended for field use or as a reference by those familiar with CR10X programming; additional details and examples are in the CR10X Operator's manual. Computer-assisted programming is supported by EDLOG and Short Cut; communications is supported by GraphTerm and TELCOM (DOS) and PC208W (Windows).

CR10KD Keystrokes

The CR10X can be interrogated or programmed via the 16 keys and display on the CR10KD. The * key is the most important because it controls access to each of the CR10X's 14 programming, data storage, and status areas ("star" modes).

Once in a star mode, use [A] & [B] to move between entries. To enter a value, use the [0] through [9] keys, then press [A]. To exit a star mode, key in a different star mode. To exit all star modes and begin logging, key in [*] [0].



General Keystrokes

- | | |
|-------------------------------------|--|
| [0]–[9] Key in data or instructions | [C] Change value, Index a parameter
Change sign of a number |
| [A] Enter (Advance) | [D] Decimal point |
| [B] Back up | [#] Clear digit just keyed |

* [0] BEGIN LOGGING (compiles program and logs data)

* [1] ENTER PROGRAM TABLE 1

- 01:xxxx Advance to a given Instruction location ("fast forward")
- 01:x.xxxx Enter Execution Interval between 1/64 and 8191s.
Valid entries are multiples of for Range of
1/64 (0.015625) s. 1/64 to 1 s.
1/8 (0.125) s. 1 to 32 s.
1 s. 32 to 8191 s.
- 01:Pxx Enter a Program Instruction (select appropriate instructions from the following pages). Entering an instruction number also loads blank entries for its associated parameters. For example, if Instruction 2 (differential volts) is desired, key in [2] [A] which loads: 01:P2
- 01:00 (Reps - repeats measurements on consecutive channels and places results in consecutive input locations)
- 02:00 (Range - see option codes)
- 03:00 (First differential channel to make measurement)
- 04:0000 (First input location where measured result will be stored)
- 05:0.0000 (Multiplier)
- 06:0.0000 (Offset)
- Key in values for each parameter then advance to next instruction in program.

* [2] ENTER PROGRAM TABLE 2

Same structure as *1. Allows use of a different Execution Interval.

* [3] ENTER PROGRAM TABLE 3 (subroutines only)

Same structure as *1 except no Execution Interval

*1, *2, and *3 Commands

- | | |
|---------|---------------------------------|
| [#] [A] | Advance to next instruction |
| [#] [B] | Back up to previous instruction |
| [#] [D] | Delete entire instruction |

* [4] PARAMETER ENTRY TABLE - See CR10X manual.

* [5] CLOCK (set or display CR10X time)

:HH:MM:SS (displays current datalogger time)

05:xxxx Year

05:xxxx Day of Year (Calendar on back)

05:HHMM Hours Minutes

* [6] INPUT STORAGE (display data values, flags, or port status. Compile program without resetting input storage, flags or ports)

06:xxxx Advance to a given Input Storage Location

*6 Commands

- | | |
|-----|---|
| [#] | Display Input Location Number or enter location to advance to |
| [C] | Enter value in Input Location; change sign |
| [D] | Display flags 1-8, toggle flag w/keys 1-8 |
| [0] | Display ports 8-1, toggle port w/keys 1-8 |

* [7] FINAL STORAGE (display values stored in area 1 or 2)

07:xx Select area 1 or 2 (skipped if 2 not allocated)

07:xxxxx DSP location; enter location to advance to

*7 Commands

- | | |
|---------|--|
| [#] | Display Final Storage location No.; enter location to advance to, or C to display data |
| [#] [A] | Advance to same element in next array w/ same ID |
| [#] [B] | Back up to same element in previous array w/ same ID |

* [8] MANUAL DATA DUMP

08:xx Select Storage Area 1 or 2 (skipped if 2 not allocated)

01:xx Output Device/Baud Code (see Inst. 96 options)

02:xxxxx Current or start Final Storage Location

03:xxxxx DSP or end Final Storage Location

04:xx Enter any number to start dump

[#] Aborts dump

* [9] STORAGE MODULE COMMANDS - See Storage Module manual

* [A] MEMORY ALLOCATIONS (display or change)

- 01:xxxx Input Storage Locations
- 02:xxxx Intermediate Storage Locations
- 03:x Final Storage Locations - Area 2
- 04:xxxxx Final Storage Locations - Area 1
- 05:xxxx.x Memory allocated for program (bytes)
- 06:xxxx.x Remaining program memory (bytes)

* [B] CR10X STATUS/ON-BOARD FIRMWARE

- 01:xxxxx Program signature
- 02:xxxxx Operating System signature
- 03:xxxxx K bytes memory: Flash + SRAM
- 04:xx No. of E08's (Key 88 to reset)
- 05:xx No. of table overruns (Key 88 to reset)
- 06:x.xxxx Operating system version number
- 07:xxxx Revision number
- 08:x.xxxx Lithium battery voltage
- 09:xx Low 12V batt. detect counter (Key 88 to reset)
- 10:xx Extended mem. error counter (Key 88 to reset)
- 11:x.xxxx Extended memory time to erase, seconds

* [C] SECURITY (display or change)

- 01:xxxx Lock *1, *2, *3, *A, *D
- 02:xxxx Lock *4, *5 & *6 display only
- 03:xxxx Lock *5, *6, *7, *8, *9, *B; telecommunication commands except A, L, N, and E

* [D] STORE OR LOAD PROGRAMS

- 1 Print program (ASCII)
- 2 Load program (ASCII), *0 compile
- 2-- Load program (ASCII), *6 compile
- 6 Store program in Flash
- 7 Load program from Flash
- 7N Store/Load/Clear program in Storage Module N (N = 1-8)
- 1x Store program x in Storage Module N
- 2x Load program x from Storage Module N
- 3x Clear program x from Storage Module N
x = program 1-8
- 8 Set Datalogger ID
- 10 Set Power-Up Options
 - 0 Clear ports, flags, timer, and input and intermediate storage
 - 1 Clear intermediate storage
 - 2 Retain ports, flags, timer and input and intermediate storage
 - 3 Do not change power-up settings



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ERROR CODES

- | | |
|---|--|
| <ul style="list-style-type: none"> 3 Program Table full 4 Intermediate Storage full 5 Final Storage Area 2 not allocated 8 CR10X was reset by watch dog timer 9 Insufficient Input Storage 10 Low battery voltage 11 Attempt to allocate unavailable storage 12 Duplicate *4 ID 20 Subroutine encountered before END of previous subroutine 21 END without IF, LOOP, or SUBROUTINE 22 Missing END 23 Non-existent SUBROUTINE 24 ELSE in SUBROUTINE without IF 25 ELSE without IF 26 EXIT LOOP without LOOP 27 IF CASE without BEGIN CASE 30 IFs and/or LOOPS nested too deep | <ul style="list-style-type: none"> 31 SUBROUTINES nested too deep 32 Instruction 3 and interrupt subroutine use same port 33 Cannot use control port 6 as counter with Instruction 15 or SDM 40 Instruction does not exist 41 Incorrect Execution Interval 60 Insufficient Input Storage 61 Burst Measurement Scan Rate too Short 62 N<2 in FFT <p>*D Mode Errors</p> <ul style="list-style-type: none"> 94 Program storage area full 95 Flash program does not exist 96 Addressed device not connected 97 Data not received within 30 seconds 98 Uncorrectable errors detected 99 Wrong file type or editor error |
|---|--|

DAY OF YEAR CALENDAR

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
JAN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
FEB	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60		
MAR	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
APR	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	
MAY	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151
JUN	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	
JUL	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212
AUG	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243
SEP	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	
OCT	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304
NOV	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	
DEC	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365

Add 1 to unshaded values during leap years.



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