

21X PROMPT SHEET

(OSX-0.1, -1.1, -2.1 PROMs)

This prompt sheet briefly describes the 21X instruction set and command structure. It is intended for field use or as a reference by those familiar with 21X programming; more detailed information and examples are available in the 21X Operator's manual. Computer-assisted programming and communications are supported by PC208 or PC208W Software.

*MODES

To enter each Mode, key in a * ("star"), followed by the desired mode number.

KEY DEFINITION SUMMARY

Common keystrokes used to interrogate and program the 21X via the keyboard/display or a remote terminal.

- | | |
|--|--|
| <p>[0]-[9] Key in numeric data, instruction number, or parameter</p> <p>[A] Enter the displayed number, or advance through a program table or data storage</p> <p>[B] Back up through a program table or data storage</p> | <p>[C] Change the sign of a floating point number, or index an input location</p> <p>[D] Enter a decimal point</p> <p>[#] Clear digit just keyed; display storage location number</p> |
|--|--|

*** [0] Compile program, begin LOGging data, indicate Active Table(s)**

*** [1] Display/Enter Program Instructions**

- 01:xx Advance to a given instruction location
- 01:x.xxxx Execution Interval:
- Valid entries are multiples of for Range of
- 0.0125 s. . . . 0.0125 to 0.1 s.
(Table 1 only)
- 0.1 s. . . . 0.1 to 6553 s.
- 01:Pxx Program Instruction (see following pages)

*** [2] Display/Enter Program Instructions**
Same structure as *1. Allows use of a different Execution Interval.

*** [3] Display/Change Subroutine Program**
Same as for *1 and *2, except that *3 does not have an Execution Interval

- *1,*2, and *3 Commands*
- | | | |
|---|-----|---------------------------------|
| # | [A] | Advance to next instruction |
| # | [B] | Back up to previous instruction |
| # | [D] | Delete entire instruction |

*** [4] Enable Final Storage Output to Peripheral Device (do not use if Instruction 96 is in program)**

- 01:AB Output Enable Code
- A Tape
0 = disabled; 1 = enabled
- B Printer
0 = disabled; 1 = enabled
- 02:0y Baud Rate Code (printer)
- | | |
|---|------------|
| 0 | 300 baud |
| 1 | 1200 baud |
| 2 | 9600 baud |
| 3 | 76800 baud |

*** [5] Display/Change Datalogger Time**

- :HH:MM:SS (displays current datalogger time)
- 05:xx Year
- 05:xxxx Day of Year (calendar on back)
- 05:HHMM Hours Minutes

*** [6] Display/Change Input Storage Data Values, Flags, or Ports. Compile Program without resetting Input Storage, Flags, or Ports**

- 06:xxxx Input Storage Location to advance to

- *6 Commands*
- | | |
|-----|---|
| # | Display Input Location Number or enter location to advance to |
| [C] | Enter value in Input Location |
| [D] | Display flags 1-8, toggle flag w/keys 1-8 |
| [0] | Display ports 6-1, toggle port w/keys 1-6 |

*** [7] Display Final Storage Data**

- 07:xxxxx DSP location or enter location to advance to

- *7 Commands*
- | | |
|-------|---|
| # | Display Final Storage location number; 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 to Tape**

- 01:xxxxx TPTR location/start of dump
- 02:xxxxx DSP location/end of dump
- 03:xx Enter any number to start dump (# Aborts dump)

*** [9] Manual Dump to Printer or Storage Module**

- 09:xx Enter Output Code
- | | | | |
|----|--------------------------|---|----------------------|
| 1y | Printable ASCII | } | y=Baud Rate (see *4) |
| 2y | Final Storage Format | | |
| 30 | SM192/716 Storage Module | | |
- 31 Filemark to SM192/716
- 01:xxxxx PPTR location/start of dump
- 02:xxxxx DSP location/end of dump
- 03:xx Enter any number to start dump

*** [A] Display/Change Memory Allocation**

- 01:xxxx Input Storage locations
- 02:xxxx Intermediate Storage locations
- 03:xxxxx Final Storage locations
- 04:xxxx Remaining program memory (bytes)

*** [B] Display Signatures/Status**

- 01:xxxxx Program signature
- 02:xxxxx First PROM signature
- 03:xxxxx Second PROM signature
- 04:xxxxx Third PROM signature
- 05:xxxx Memory Test
- 06:xx Number of E08 Errors
- 07:xx Number of Overrun Errors
- 08:xxxx.x Version number
- 09:xxxx Revision number

*** [C] Display/Change Security (OSX-0.1 only)**

- 12:0000 (if enabled) Enter password
- 01:xx
- 00 Temporarily disable security
- 01 Advance to window 2 to set new password
- 02:xxxx Set password, 0000 disables security if window 1 is set to 0

*** [D] Store/Load Program**

- 13:xx Enter Command (Commands 1 and 2 require baud rate code. See *4 mode)
- 1 – Print program (ASCII)
- 2 – Load program (ASCII)
- 71 – Store/Load/Clear program from Storage Module

Storage Module Command Codes

- 1z Store program z in Storage Module
- 2z Load program z from Storage Module
- 3z Clear program z from Storage Module
- z = program 1-8

NOTE: x represents a digit from 0 to 9 unless otherwise defined

21X INSTRUCTIONS AND PARAMETERS

INPUT/OUTPUT INSTRUCTIONS

INST.	01:	02:	03:	04:	05:	06:	07:	08:	09:	
1	VOLT (SE)	REPS	RANGE†	SE CHAN	LOC	MULT	OFFSET			
2	VOLT (DIFF)	REPS	RANGE†	DIFF CHAN	LOC	MULT	OFFSET			
3	PULSE	REPS	PULSE CHAN	CONFIG†	LOC	MULT	OFFSET			
4	EXCIT-DEL-SE	REPS	RANGE†	SE CHAN	EXCIT CHAN†	DELAY 0.01s	EXCIT mV	LOC	MULT	OFFSET
5	AC HALF BR	REPS	RANGE†	SE CHAN	EXCIT CHAN†	EXCIT mV	LOC	MULT	OFFSET	
6	FULL BR	REPS	RANGE†	DIFF CHAN	EXCIT CHAN†	EXCIT mV	LOC	MULT	OFFSET	
7	3W HALF BR	REPS	RANGE†	SE CHAN	EXCIT CHAN†	EXCIT mV	LOC	MULT	OFFSET	
8	EXCIT-DEL-DIFF	REPS	RANGE†	DIFF CHAN	EXCIT CHAN†	DELAY 0.01s	EXCIT mV	LOC	MULT	OFFSET
9	FULL BR w/ MEAS EXCIT	REPS	EXCIT RANGE†	BR RANGE†	DIFF CHAN	EXCIT CHAN†	EXCIT mV	LOC	MULT	OFFSET
10	BATT VOLT	LOC								
11	TEMP-(107)	REPS	SE CHAN	EXCIT CHAN†	LOC	MULT	OFFSET			
12	RH (207)	REPS	SE CHAN	EXCIT CHAN†	TEMP LOC	RH LOC	MULT	OFFSET		
13	TEMP-TC (SE)	REPS	RANGE†	SE CHAN	TC TYPE†	REF LOC	LOC	MULT	OFFSET	
14	TEMP-TC (DIFF)	REPS	RANGE†	DIFF CHAN	TC TYPE†	REF LOC	LOC	MULT	OFFSET	
16	TEMP-RTD	REPS	R/Ro LOC	LOC	MULT	OFFSET				
17	TEMP-PANEL	LOC								
18	TIME	OPTION†	MOD/BY	LOC						
19	SIGNATURE	LOC								
20	PORT SET	OPTION†	PORT NO							
21	ANALOG OUT	CAO CHAN	mV LOC							
22	EXCIT-DEL	EXCIT CHAN	DEL w/ excit	DEL after excit	EXCIT mV	(delay units-0.01s)				
‡23	see below									
26	TIMER	LOC (0 resets timer)								
*§101	SDM-INT8	ADDR	C:8765†	C:4321†	F:8765†	F:4321†	OUT OPT†	LOC	MULT	OFFSET
*§102	SDM-SW8A	REPS	ADDR	FUNCTION†	CHAN	LOC	MULT	OFFSET		
*§103	SDM-AO4	REPS	ADDR	LOC						
*§104	SDM-CD16	REPS	ADDR	LOC						

INST.	01:	02:	03:	04:	05:	06:	07:	08:	09:	10:	11:	12:	
‡23	BURST MODE	NO CHAN	RANGE†	IN CHAN	OPTION†	SCAN(ms)	SCANS (10 ³)	TR OFF	TR LIM mV	EXCIT mV	LOC	MULT	OFFSET

†Option Codes

INST. 1-14	RANGE codes: Slow (16.67 ms integ time) Fast (250 µs integ time) Full scale range 1 11 ± 5 mV 2 12 ± 15 mV 3 13 ± 50 mV 4 14 ± 500 mV 5 15 ± 5000 mV	20 OPTION code: 00 Set low 01 Set high 1x Set according to flag x 2x Set opposite flag x	101 C:8765, C:4321 Each digit Configures respective channel: 0 High level, rising edge 1 High level, falling edge 2 Low level, rising edge 3 Low level, falling edge
3	CONFIGuration codes: To record all counts: 0 High frequency 1 Low level AC 2 Switch Closure 3 High frequency, 16 bit 4 Low level AC, 16 bit To discard counts from excessive intervals 1x (x= 0-4 from above) Discard counts, output frequency (Hz) 2x (x= 0-4 from above)	23 RANGE codes: (250 µs integ time) Full scale range 12 ± 15 mV 13 ± 50 mV 14 ± 500 mV 15 ± 5000 mV	101 F:8765, F:4321 Each digit sets Function for respective channel: 0 No value returned 1 Period, ms 2 Frequency, kHz 3 Time since previous channel, ms 4 Time since channel 1, ms 5 Counts on 2 since 1, interpolated 6 Low resolution frequency, kHz 7 Counts 8 Integral counts on 2 since 1
4-12	EXCIT CHANnel codes: 0x Excite all reps w/ EXCIT CHAN x 1x Increment EXCIT CHAN w/ each rep	23 OPTION code, 4 digits: ABCD A Trigger 0 -- Trigger on 1st analog channel used 1 -- Digital trigger on SE channel 1H 2 -- Same as 0, but sets Control #1 high on trigger, low when finished B Trigger option 0 -- Trigger immediately 1 -- Trigger if above limit (high) 2 -- Trigger if below limit (low) 3 -- Trigger on rising edge 4 -- Trigger on falling edge C Destination 0 -- Input Storage 1 -- Serial port, 9600 baud 2 -- Serial port, 76,800 baud D Measurement 0 -- Differential measurement 1 -- Single-ended measurement	101 OUTPUT OPTION: 0 Average over execution interval 0-- Continuous averaging xxxx Specify avg interval in ms xxxx-- Capture all events until xxxx edges of channel 1 9999-- Test Memory
13,14	TC TYPE –Thermocouple Type codes: 1 T (copper-constantan) 2 E (chromel-constantan) 3 K (chromel-alumel) 4 J (iron-constantan) For common mode error checking (DIFF only) 9x (x= 1-4 from above)		102 FUNCTION: 0 Channel state 1 Duty cycle 2 Counts 3 Memory test
18	OPTION codes: 0 0.1 seconds into minute (max 600) 1 minutes into day (max 1440) 2 hours into year (max 8784)		

• STANDARD IN OSX-0.1

§ STANDARD IN OSX-1.1

‡ STANDARD IN OSX-2.1

PROCESSING INSTRUCTIONS

(F is fixed data (constant); X, Y, & Z are input locations)

INST.	01:	02:	03:	INST.	01:	02:	03:	04:	05:	06:	07:	08:	09:	
30	Z=F	F	Z	47	Z=X ^Y	X	Y	Z						
31	Z=X	X	Z	48	Z=SIN(X)	X	Z							
32	Z=Z+1	Z		49	SPA MAX	SWATH	1ST LOC	MAX†						
33	Z=X+Y	X	Y	50	SPA MIN	SWATH	1ST LOC	MIN†						
34	Z=X+F	X	F	51	SPA AVG	SWATH	1ST LOC	AVG						
35	Z=X-Y	X	Y	53	A * X+B	STRT LOC	A1	B1	A2	B2	A3	B3	A4	B4
36	Z=X * Y	X	Y	54	BLOCK MOVE	NO VALS	S LOC	STEP	D LOC	STEP				
37	Z=X * F	X	F	55	POLYNOMIAL	REPS	X	F(X)	C0	C1	C2	C3	C4	C5
38	Z=X/Y	X	Y	56	SAT VP	TEMP	VP							
39	Z=SQRT(X)	X	Z	57	WB/DB T to VP	PRESSURE	DB TEMP	WB TEMP	VP					
40	Z=LN(X)	X	Z	58	LP FILTER	REPS	X	F(X)	WGHT F					
41	Z=EXP(X)	X	Z	59	X/(1-X)	REPS	X	MULT						
42	Z=1/X	X	Z	60	FFT	LOG ₂ (SMPL)	OPTIONS†	LOG ₂ (BIN/AVG)	IN LOC	MULT				
43	Z=ABS(X)	X	Z	61	INDIR MOVE	SOURCE	DESTIN							
44	Z=FRAC(X)	X	Z	62	(see below)									
45	Z=INT(X)	X	Z	66	Z=ARCTAN(X/Y)	X	Y	Z						
46	Z=X MOD F	X	F											

INST.	01:	02:	03:	04:	05:	06:	07:	08:	09:	
62	COV/CORR	NO VALS	NO MEANS	NO VARS	NO S DEVS	NO COVARs	NO CORRs	NO SAMPLES	S LOC	D LOC

†Option Codes

INST.

49,50 MAX/MIN:

0xxx Store spatial max or min at location xxx
 1xxx Max or min at location xxx and location of max or min at xxx+1
 x = 1 Orthogonal (East & North)

60 OPTION code:

0x Power Spectra
 1x Real and Imaginary
 2x Magnitude and Phase
 x=0 No Taper
 x=1 Taper

OUTPUT PROCESSING INSTRUCTIONS

INST.	01:	02:	03:	04:	05:	INST.	01:	02:	03:	04:	05:	06:	07:		
69	WIND VECTOR	REPS	SMPL/SUB INT	SEN OUT†	WS/E	WD/N	75	HISTOGRAM	REPS	BINS	FORM†	B SEL LOC	WV LOC†	LOW LIM	HIGH LIM
70	SAMPLE	REPS	LOC				77	REAL TIME	OPTION†						
71	AVERAGE	REPS	LOC				78	RESOLUTION	OPTION†						
72	TOTALIZE	REPS	LOC				79	SMPL ON M M	REPS	LOC (must follow Inst 73 or 74)					
73	MAXIMUM	REPS	TIME†	LOC			80	STORE AREA	AREA†	LOC/ID					
74	MINIMUM	REPS	TIME†	LOC			81	see below							
							82	STD DEV	REPS	LOC					

INST.	01:	02:	03:	04:	05:	06:	07:	08:	09:	10:	
81	RAINFLOW HISTOGRAM	REPS	S LOC	SWATH	MEAN BINS	AMP BINS	LOW LIM	HIGH LIM	MIN AMP	OPTION†	D LOC

†Option Codes

<p>INST. 69 SENSOR/OUTPUT type codes:</p> <p>x0 Avg WS, θ_1; $\sigma(\theta_1)$ x1 Avg WS, θ_1 x2 Avg WS, resultant U, θ_u; $\sigma(\theta_u)$ x = 0 Polar (speed & direction) x = 1 Orthogonal (East & North)</p> <p>73,74 TIME of max or min:</p> <p>00 Max/min value only 01 With Seconds 10 With Hour-Minute 11 With Hour-Minute, Seconds</p>	<p>75 FORM codes:</p> <p>0 Open form (data beyond limits is included) 1 Closed form (data beyond limits is excluded)</p> <p>WV LOCATION:</p> <p>0 frequency distribution</p>	<p>77 OPTION codes:</p> <p>xxx1 Seconds xx1x Hour-Minute xx2x Hour-Minute, 2400 at midnight x1xx Day x2xx Day, Previous day at midnight 1xxx Year (0 = no output, e.g., 110 = Day, Hour-Minute)</p>	<p>78 OPTION codes:</p> <p>0 Low resolution 1 High resolution</p> <p>80 AREA codes:</p> <p>1 Final Storage 3 Input Storage</p> <p>81 OPTION codes, 2 Digits:</p> <p>00 - Closed form/Fraction output 01 - Closed form/Counts output 10 - Open form/Fraction output 11 - Open form/Counts output</p>
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PROGRAM CONTROL INSTRUCTIONS

(F is fixed data (constant); X, Y, & Z are input locations)

INST.	01:	02:	03:	04:	INST.	01:	02:	03:	04:	INST.	01:	
83	IF CASE < F	F	CMD†		89	IF X <=> F	X	COMP†	F	CMD†	94	ELSE
85	LABEL SUBR	SUBR# (1-9, 79-99)			90	LOOP INDEX	STEP			95	END	
86	DO	CMD†			91	IF FLAG/INPUT	OPTION†	CMD†		96	SERIAL OUT†	OPTION†
87	LOOP	DELAY	COUNT		92	IF TIME	T into INT	INT (min)	CMD†	97	see below	
88	IF X <=> Y	X	COMP†	Y	CMD†	93	BEGIN CASE	CASE LOC		98	SEND CHAR	BAUD/CHAR†

INST.	01:	02:	03:	04:	05:	06:	07:	08:	09:	...	10+(X)	...	
97	INIT TELE	OPTION†	FLAG	LIM (SEC)	F DEL(SEC)	NO TRYs	S DEL(MIN)	FAILURE LOC	ID	NO of RF STA(X)	STA IDS	NO DIGITS	PHONE NO

†Option Codes

<p>INST. 83-93 CoMmanD codes:</p> <p>0 Go to end of Program Table 1-9, 79-99 Call Subroutine 10-19 Set flag 0-9 high 20-29 Set flag 0-9 low 30 Then Do 31 Exit Loop if true 32 Exit Loop if false 41-46 Set Port 1-6 high 51-56 Set Port 1-6 low 61-66 Toggle Port 1-6 71-76 Pulse Port 1-6</p>	<p>88,89 COMParison codes:</p> <p>1 = 2 ≠ 3 ≥ 4 <</p> <p>91 OPTION codes:</p> <p>1x Do if flag x is high 2x Do if flag x is low 4x Do if input x is high 5x Do if input x is low "Input" refers to high side of differential channel</p> <p>96 SERIAL OUT Cannot output to both printer and Storage Module.</p>	<p>96 OPTION codes:</p> <p>00 Tape 1y Printer, ASCII 2y Printer, Binary 30 SM192/716 31 Filemark to SM192/716</p> <p>97 OPTION codes:</p> <p>0y RF modem 1y DIRECT 2y DC112</p> <p>98 BAUD/CHARacter Value yxxx xxx = ASCII Value (0-127) (y = Baud Rate Code)</p>	<p>FLAG DESCRIPTIONS:</p> <p>0 Output Flag 1-8 User Flags 9 Intermed proc disable flag</p> <p>BAUD RATE CODES:</p> <p>y= 0 300 baud 1 1200 baud 2 9600 baud 3 76,800 baud</p>
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ERROR CODES

3 -- Program Table full
 4 -- Intermediate Storage full
 8 -- 21X was reset by watch dog timer
 9 -- Insufficient Input Storage
 11 -- Attempt to allocate unavailable storage
 20 -- Subroutine encountered before necessary END
 21 -- END without IF, LOOP, or SUBROUTINE
 22 -- Missing END, nonexistent SUBROUTINE
 24 -- ELSE in SUBROUTINE without IF
 25 -- ELSE without IF
 26 -- EXIT LOOP without LOOP

30 -- IFs and/or LOOPS nested too deep
 31 -- SUBROUTINES nested too deep
 40 -- Table 2 Execution Interval too short or
 Instruction does not exist
 60 -- Inadequate Input Storage for Burst/FFT
 61 -- Burst Mode Scan Rate too short

*D Mode Errors

97 -- Time out on tape read
 98 -- Uncorrectable errors on tape read
 99 -- Wrong file type, program error, or program not
 received

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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