

CR10 INSTRUCTION AND PARAMETER SUMMARY

INPUT/OUTPUT INSTRUCTIONS

INST.	01:	02:	03:	04:	05:	06:	07:	08:	09:	10:	
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	EX-DEL-SE	REPS	RANGE†	SE CHAN	EX. CHAN†	DELAY 0.01s	EXCIT mV	LOC	MULT	OFFSET	
5	AC HALF BR.	REPS	RANGE†	SE CHAN	EX. CHAN†	EXCIT mV	LOC	MULT	OFFSET		
6	FULL BR.	REPS	RANGE†	DIFF CHAN	EX. CHAN†	EXCIT mV	LOC	MULT	OFFSET		
7	3W HALF BR.	REPS	RANGE†	SE CHAN	EX. CHAN†	EXCIT mV	LOC	MULT	OFFSET		
8	EX-DEL-DIFF	REPS	RANGE†	DIFF CHAN	EX. CHAN†	DELAY 0.01s	EXCIT mV	LOC	MULT	OFFSET	
9	FULL BR. w/M. EX.	REPS	EX. RANGE†	BR. RANGE†	DIFF CHAN	EX. CHAN†	EXCIT mV	LOC	MULT	OFFSET	
10	BATT VOLT	LOC									
11	TEMP-(107)	REPS	SE CHAN	EX. CHAN†	LOC	MULT	OFFSET				
§ 12	R.H. (207)	REPS	SE CHAN	EX. CHAN†	TEMP LOC	R.H. LOC	MULT	OFFSET			
13	TC TEMP (SE)	REPS	RANGE†	SE CHAN	TC TYPE†	REF. LOC	LOC	MULT	OFFSET		
14	TC TEMP (DIFF)	REPS	RANGE†	DIFF CHAN	TC TYPE†	REF. LOC	LOC	MULT	OFFSET		
16	RTD TEMP	REPS	R/Ro LOC	LOC	MULT	OFFSET					
17	INTERNAL TEMP	LOC									
18	TIME	OPTION†	MOD/BY	LOC							
19	SIGNATURE	LOC									
20	PORT SET	8765†	4321†								
22	EXCIT w/DEL	EX.CHAN	DEL w/ex.	DEL after ex.	EXCIT mV	(del. units-0.01s)					
§ 24	CALIBRATION	LOC†									
25	READ PORTS	MASK†	LOC†								
26	TIMER	LOC (0 resets timer)									
27	PERIOD AVG (SE)	REPS	OP/GAIN†	SE CHAN	NO. CYC.	LIM (0.01s)	LOC	MULT	OFFSET		
28	VIB. WIRE (SE)	REPS†	SE CHAN	EX CHAN	START F.†	END F.†	NO. CYC.	DEL 0.01s	LOC†	MULT	OFFSET
♦29	PS9105	DIFF CHAN	EX.CHAN	LOC	ENHANCED PARAMATERS (CSI	PARAMATERS 4-23)†					
101	SDM-INT8	ADDR	C:8765†	C:4321†	F:8765†	F:4321†	OUT. OPT.†	LOC	MULT	OFFSET	
102	SDM-SW8A	REPS	ADDR	FUNCT†	CHAN	LOC	MULT	OFFSET			
103	SDM-A04	REPS	ADDR	LOC							
104	SDM-CD16	REPS	ADDR	LOC							
♦§105	SDI-12 RECORDER	ADDR	CMD†	PORT	LOC	MULT	OFFSET				
§106	SDI-12 SENSOR	ADDR	TIME/VAL†	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

<p>1-14 RANGE codes:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td colspan="4">Slow (2.72 ms integration time)</td><td>13 ± 25 mV</td><td>CSI Par.</td><td>Enhanced Par.</td></tr> <tr><td colspan="4">Fast (250 µs integration time)</td><td>14 ± 250 mV</td><td>04:</td><td>1</td></tr> <tr><td colspan="4">60 Hz rejection</td><td>15 ± 2500 mV</td><td>05:</td><td>2</td></tr> <tr><td colspan="4">50 Hz rejection</td><td></td><td>06:</td><td>3</td></tr> <tr><td></td><td>I</td><td></td><td>Full scale range</td><td></td><td></td><td></td></tr> <tr><td>1</td><td>11</td><td>21</td><td>31 ± 2.5 mV</td><td></td><td></td><td></td></tr> <tr><td>2</td><td>12</td><td>22</td><td>32 ± 7.5 mV</td><td></td><td></td><td></td></tr> <tr><td>3</td><td>13</td><td>23</td><td>33 ± 25 mV</td><td></td><td></td><td></td></tr> <tr><td>4</td><td>14</td><td>24</td><td>34 ± 250 mV</td><td></td><td></td><td></td></tr> <tr><td>5</td><td>15</td><td>25</td><td>35 ± 2500 mV</td><td></td><td></td><td></td></tr> </table> <p>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 Discard counts beyond execution Interval 1x (x = 0-4 from above) Discard counts, output frequency (Hz) 2x (x = 0-4 from above)</p> <p>4-12 Excitation CHANnel codes: 0x Excite all reps with EX CHAN x 1x Increment EX CHAN x with each rep</p> <p>13, 14 ThermoCouple TYPE codes: 1 T (copper-constantan) 2 E (chromel-constantan) 3 K (chromel-alumel) 4 J (iron-constantan) 8x (x = TC Code 1-4; used w/A5B40 only) 9x (x = TC Code 1-4; common mode error checking; Inst. 14 only)</p> <p>18 OPTION codes: 0 seconds into minute (max 60) 1 minutes into day (max 1440) 2 hours into year (max 8784)</p> <p>20 8765, 4321 Each digit configures respective port 0 Set low 1 Set high 2 Toggle 3 Pulse 1 ms 4 Pulse 10 ms 5 Pulse 100 ms 6 Pulse 1 sec 7 Configure as output 8 Configure as input 9 No change</p> <p>23 RANGE codes: Fast (250 µs integration time) Full scale range</p>	Slow (2.72 ms integration time)				13 ± 25 mV	CSI Par.	Enhanced Par.	Fast (250 µs integration time)				14 ± 250 mV	04:	1	60 Hz rejection				15 ± 2500 mV	05:	2	50 Hz rejection					06:	3		I		Full scale range				1	11	21	31 ± 2.5 mV				2	12	22	32 ± 7.5 mV				3	13	23	33 ± 25 mV				4	14	24	34 ± 250 mV				5	15	25	35 ± 2500 mV				<p>23 OPTION code, 4 digits: ABCD A Trigger 0 -- Trigger on 1st analog channel 1 -- Digital trigger on C1 2 -- Same as 0, but sets C1 high on trigger 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, 76800 baud 3 -- Serial port, 76800 baud to SM192/SM716 Storage Module D Measurement 0 -- Differential measurement 1 -- Single-ended measurement</p> <p>24 LOCation (start of 19 calibration values) xxxx Calibrate only when 24 is executed xxxx-- (key in C before entering) store results of automatic calibration</p> <p>25 MASK: Base 2 representation of ports 8-1; 1 means read, 0 yields 0. Entered as base 10 (0-255).</p> <p>LOCation: Result also base 2 converted to 10 1 indicates high, 0 indicates low or masked</p> <p>27 Option/GAIN codes:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th>Code</th><th>Gain</th></tr> <tr><td>x1</td><td>100</td></tr> <tr><td>x2</td><td>33.3</td></tr> <tr><td>x3</td><td>10</td></tr> <tr><td>x4</td><td>1</td></tr> <tr><td>x = 0</td><td>Output period in microseconds</td></tr> <tr><td>x = 1</td><td>Output frequency in kHz</td></tr> </table> <p>28 REPS: Hit C (-) to skip repeat of excit. START Frequency of sweep (100's of Hz) END Frequency of sweep (100's of Hz) LOC: Output is 1/T², T is period in ms</p> <p>29 Enhanced Parameters These parameters are listed on the manufacturer's calibration sheet, where:</p>	Code	Gain	x1	100	x2	33.3	x3	10	x4	1	x = 0	Output period in microseconds	x = 1	Output frequency in kHz	<p>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</p> <p>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</p> <p>101 OUTPUT OPTION 0 Execution interval averaging 0-- Continuous averaging xxxx Specify average interval in ms xxxx-- Capture all events until xxxx edges of channel 1 9999-- Test Memory</p> <p>102 FUNCTION 0 Channel state 1 Duty cycle 2 Counts 3 Memory test</p> <p>105 SDI-12 CoMmanD codes:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr><th>Entry</th><th>Command</th><th>Description</th></tr> </thead> <tbody> <tr><td>0</td><td>M</td><td>Initiate measurement</td></tr> <tr><td>1..9</td><td>M1..M9</td><td>Additional measurement commands specified by the SDI-12 sensor</td></tr> <tr><td>10</td><td>V</td><td>Initiate verify sequence</td></tr> <tr><td>11</td><td>I</td><td>Send identification</td></tr> </tbody> </table> <p>106 TIME/VALues codes: ttn: ttt = time (seconds) n = No. values</p>	Entry	Command	Description	0	M	Initiate measurement	1..9	M1..M9	Additional measurement commands specified by the SDI-12 sensor	10	V	Initiate verify sequence	11	I	Send identification
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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	EXP 10 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 LOC†							
33	Z=X+Y	X	Y	Z	50	SPA. MIN	SWATH	1ST LOC	MIN LOC†						
34	Z=X+F	X	F	Z	51	SPA. AVG	SWATH	1ST LOC	AVG LOC						
35	Z=X-Y	X	Y	Z	53	A * X+B	START LOC	A1	B1	B2	A3	B3	A4	B4	
36	Z=X * Y	X	Y	Z	54	BLOCK MOVE	NO. VALS	S.LOC	STEP	D.LOC	STEP				
37	Z=X * F	X	F	Z	55	POLYNOMIAL	REPS	X	F(X)	C0	C1	C2	C3	C4	C5
38	Z=X/Y	X	Y	Z	§56	SAT. VP	TEMP	VP							
39	Z=SQRT(X)	X	Z		§57	WB/DBT to VP	PRESSURE	DB TEMP	WB TEMP	VP					
40	Z=LN(X)	X	Z		58	LP FILTER	REPS	INPUT X	RESULT X	WGHT.F.					
41	Z=EXP(X)	X	Z		59	RF (X/1-X)	REPS	X	MULT (RF)						
42	Z=1/X	X	Z		61	INDIR MOVE	SOURCE X	DESTIN X							
43	Z=ABS(X)	X	Z		63	PARA. EXTN.	†(8 parameters, depends on the inst. that 63 follows)								
44	Z=FRAC(X)	X	Z		§64	PAROSCIENTIFIC	START LOC†	START LOC†							
45	Z=INT(X)	X	Z		♦§65	BULK LOAD	F	F	F	F	F	F	F	F	LOC
46	Z=X MOD F	X	F	Z	66	Z=ARCTAN(X/Y)	X	Y	Z						

† Option Codes

<p>49, 50 MAX/MIN: 0xxx Store spatial max or min at loc xxx 1xxx Store max or min at loc xxx and loc of max or min at xxx+1</p>	<p>63 PARAMETERS 1-8: Following Inst. 97 RF IDs & Phone No.; 1 digit at a time 32 Between RF IDs (e.g. repeater & site) 84 Between RF & DC112 No. 13 To end</p>	<p>Following Inst. 98 (256 character limit) Base 10 value of ASCII Character (1-99) 00 To end</p> <p>64 START LOC: Para. 1 Start Loc: Temp (µs), pressure (µs), V0...T5 Para. 2 Start Loc: Temp (°C), Signature</p>
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OUTPUT PROCESSING INSTRUCTIONS

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

† Option Codes

<p>69 SaMPLes/SUBINTErval (std dev): 0 No subinterval xxxx Number of scans per subinterval</p> <p>SENsor type/OUTput codes: x0 Avg WS, Θ_1; σ (Θ_1) x1 Avg WS, Θ_1 x2 Avg WS, resultant U, Θ_u; σ (Θ_u) x = 0 (anemometers & vanes) x = 1 (north- & east-facing propellers)</p> <p>Where: Θ_1 = Avg unit vector dir $\sigma(\Theta_1)$ = Std dev dir (Yamartino) Θ_u = Avg resultant vector dir $\sigma(\Theta_u)$ = Std dev dir (CSI)</p>	<p>73,74 TIME of max or min: 00 Max/min value only 01 With seconds 10 With Hour-Minute 11 With Hour-Minute, Second</p> <p>75 FORM codes: 0 Open form (data beyond limits are included) 1 Closed form (data beyond limits are excluded)</p> <p>WV LOCation: 0 frequency distribution xxxx Weighted value loc</p>	<p>77 OPTION codes: 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, Hr-Min)</p> <p>78 OPTION codes: 0 Low resolution 1 High resolution</p> <p>80 AREA codes: 1 Final Storage 1 2 Final Storage 2</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:	05:	06:	07:	08:		
83	IF CASE < F	F	CMD†		92	IF TIME	T into INT†	INT	CMD†						
85	BEGIN SUBR	SUBR†			93	BEGIN CASE	CASE LOC								
86	DO	CMD†			94	ELSE									
87	LOOP	DELAY	COUNT		95	END									
88	IF X <= > Y	X	COMP†	Y	CMD†	96	SERIAL OUT	DEVICE†							
89	IF X <= > F	X	COMP†	F	CMD†	97	INITIATE TELE.	MODEM†	FLAG	LIM(sec)	F.DEL(sec)	NO. TRIES	S.DEL (min)	FAIL LOC	ID
90	LOOP INDEX	STEP			98	SEND CHAR.	DEVICE†								
91	IF FLAG/PORT	COMP†	CMD†												

† Option Codes

<p>83-92 CoMmanD codes: 0 Go to end of Pgm. 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 41-48 Set Port 1-8 high 51-58 Set Port 1-8 low 61-68 Toggle Port 1-8 71-78 Pulse Port 1-8 Ports can be indexed with C (--)</p> <p>85 Subroutine number valid entries are 1-9, 79-99; 97 & 98 allow special interrupts on C7 & C8</p> <p>88,89 COMParison codes: 1 = 3 ≥ 2 ≠ 4 <</p> <p>91 COMParison codes: 1x Do if flag x is high 2x Do if flag x is low</p>	<p>92 Time into INTerval xxx T and INT in minutes xxx-- T and INT in seconds</p> <p>FLAG DESCRIPTIONS: 0 Output flag 1-8 User flags 9 Intermed. proc. disable flag</p> <p>96,*8 DEVICE/baud codes: Tape 00 Tape, 512 Loc. blocks 09 Tape, all new data (Inst. 96 only) Addressed Print Device 1y Printable ASCII 2y Comma delineated ASCII 3y Binary Final Storage format Serial Printer or Computer 4y Printable ASCII 5y Comma delineated ASCII 6y Binary Final Storage format</p>	<p>y = Baud Rate Code</p> <p>Storage Module 7N Storage Module, address N (1-8) 7N -- Filemark to Storage Module N (1-8)</p> <p>Transfer Data to Other Final Storage Area 80 New data only (Inst. 96 only) 81 All data (Inst. 96 only)</p> <p>97 MODEM/baud codes: 0y RF MODEM 1y SHORT HAUL 2y DC112</p> <p>y = Baud Rate Code (97 is followed by Inst. 63)</p> <p>98 DEVICE/baud codes: 1y Addressed Print Device 4y Pin-Enabled Print Device y = Baud Rate Code (98 is followed by Inst. 63)</p> <p style="text-align: center;">BAUD RATE CODES</p> <table border="0" style="width: 100%;"> <tr> <td>0</td> <td>300</td> <td>2</td> <td>9600</td> </tr> <tr> <td>1</td> <td>1200</td> <td>3</td> <td>76800</td> </tr> </table>	0	300	2	9600	1	1200	3	76800
0	300	2	9600							
1	1200	3	76800							

ERROR CODES

- | | |
|--|---|
| <ul style="list-style-type: none"> 3 -- Program Table full 4 -- Intermediate Storage full 5 -- Final Storage Area 2 not allocated 8 -- CR10 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 23 -- SUBROUTINE does not exist 24 -- ELSE in SUBROUTINE without IF 25 -- ELSE without IF 26 -- EXIT LOOP without LOOP | <ul style="list-style-type: none"> 27 -- IF CASE without BEGIN CASE 30 -- IFs and/or LOOPS nested too deep 31 -- SUBROUTINES nested too deep 40 -- Instruction does not exist 41 -- Incorrect Execution Interval 60 -- Insufficient Input Storage for FFT 61 -- Burst Measurement Scan Rate too Short <p>*D Mode Errors</p> <ul style="list-style-type: none"> 96 -- Device not connected 97 -- Time out on tape read 98 -- Uncorrectable errors on tape read 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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