

**CR300**

Measurement and Control Datalogger

All CR300 dataloggers are tested and guaranteed to meet electrical specifications in a standard -40° to +70°C non-condensing environment. Datalogger recalibration is recommended every three years. System configuration and critical specifications should be confirmed with Campbell Scientific before purchase.

ANALOG

Six terminals may be configured to make analog voltage or ratiometric measurements or configured as digital I/O.

VOLTAGE MEASUREMENTS (SE1 – SE6)

Up to three differential or six single-ended terminals configured for voltage measurements using a 24-bit Adc, one at a time.

INPUT RESISTANCE: 5 GΩ ($f_{NI} = 50/60$), 300 MΩ ($f_{NI} = 4000$)

INPUT LIMITS: -100 mV to +2500 mV

SUSTAINED INPUT VOLTAGE WITHOUT DAMAGE: -6 V/+9 V (SE1, SE2), ±17 V (SE3 to SE6)

DC COMMON MODE REJECTION: > 120 dB with input reversal (≥90 dB without input reversal)

NORMAL MODE REJECTION: > 71 dB @ 50 Hz, > 74 dB @ 60 Hz

INPUT CURRENT @ 25°C: ±0.8 nA ($f_{NI} = 50/60$), ±13 nA ($f_{NI} = 4000$)

RANGE AND RESOLUTION:

Notch Frequency (f_{NI}) (Hz)	Range ¹ (mV)	Typical Resolution ² (Differential w/Input Reversal)		Typical Resolution ² (Differential w/o Input Reversal)	
		Effective Resolution		Effective Resolution	
		RMS μ V	bits	RMS μ V	bits
4000	-100 to +2500	23	16.8	33	16.3
	-34 to +34	3.0	14.5	4.2	14.0
400	-100 to +2500	3.8	19.4	5.4	18.9
	-34 to +34	0.58	16.8	0.82	16.3
50/60	-100 to +2500	1.6	20.6	2.3	20.1
	-34 to +34	0.23	18.2	0.33	17.7

ACCURACY:^{4,5}

0° to 40°C	-40° to 70°C
±(0.04% of reading + offset)	±(0.1% of reading + offset)

OFFSETS:

Range (mV)	Differential with Input Reversal (μ V)	Differential without Input Reversal (μ V)	Single-Ended (μ V)
-100 to +2500	±20	±40	±60
-34 to +34	±6	±14	±20

MEASUREMENT SPEED: (multiplexed measurement time (ms) * reps + 0.8 ms)

f_{NI} (Hz)	Multiplexed Measurement Time (ms)	
	w/Input Reversal	SE or w/o Input Reversal
4000	2.9	1.4
400	14.6	7.3
50/60	103	51.5

DEFAULT SETTLING TIME: 500 μ s

RATIOMETRIC MEASUREMENTS (SE1 – SE6)

Resistance measurements for four- and six-wire full bridge and two-, three-, and four-wire half bridge using voltage excitation.

RATIOMETRIC ACCURACY:^{4,5}

0° to 40°C	-40° to 70°C
±(0.05% of voltage measurement + offset)	±(0.06% of voltage measurement + offset)

CURRENT MEASUREMENTS (SE1, SE2)

Two analog inputs may be configured as independent 0 to 20 mA or 4 to 20 mA current loop inputs (not isolated) measured one at a time using the 24-bit Adc

ACCURACY:

0° to 40°C	-40° to 70°C
± 0.14% of reading	± 0.26% of reading

DIGITAL

PERIOD AVERAGE (SE1 – SE4)

Up to four analog inputs can be used for period averaging, one at a time.

ACCURACY: ±(0.01% of reading + resolution), where resolution is 13 ns divided by the specified number of cycles to be measured.

FREQUENCY RANGE: 5 Hz to 200 kHz.

DIGITAL I/O (SE1 – SE4)

I/O HIGH STATE: 3.3 V

I/O LOW STATE: 0 V

DRIVE CURRENT @ 3.0 V: 100 μ A

MAXIMUM INPUT VOLTAGE: -6 V/+9 V (SE1, SE2), ±17 V (SE3, SE4)

DIGITAL I/O (C1, C2)

I/O HIGH STATE: 5.0 V (output); 3.3 V logic (input)

I/O LOW STATE: 0 V

DRIVE CURRENT @ 3.5 V: 10 mA

MAXIMUM INPUT VOLTAGE: -10 V/+15 V

¹Range overhead of ~10% beyond range guarantees that full-scale values will not cause over range.

²Effective resolution (ER) in bits is computed from ratio of full-scale range to RMS resolution.

³Accuracy does not include the sensor and measurement noise.

⁴Assumes input reversal for differential measurements not including bridge resistor errors and sensor and measurement noise.

⁵Ratiometric accuracy, rather than absolute accuracy, determines overall measurement accuracy of ratiometric resistance measurements.



PULSE COUNTING

SWITCH CLOSURE (P_SW)

MINIMUM SWITCH CLOSED TIME: 3 ms
MINIMUM SWITCH OPEN TIME: 3 ms
MAXIMUM BOUNCE TIME: 1 ms open w/o being counted
MAXIMUM INPUT FREQUENCY: 150 Hz
MAXIMUM INPUT VOLTAGE: ±17 Vdc

SWITCH CLOSURE (C1, C2)⁶

MAXIMUM INPUT FREQUENCY: 150 Hz
MINIMUM SWITCH OPEN TIME: 3 ms

HIGH-FREQUENCY (C1, C2, SE1 – SE4, P_SW, P_LL)

C1-C2: 3 kHz, maximum,
SE1-SE4: 35 kHz, maximum
P_SW: 35 kHz, maximum
P_LL: 20 kHz, maximum

LOW-LEVEL AC (P_LL)

RANGE (dependent on sine wave input)⁷

Sine Wave (mV RMS)	Range(Hz)
20	1.0 to 20
200	0.5 to 200
2000	0.3 to 10,000
5000	0.3 to 20,000

INPUT HYSTERESIS: 12 mV @ 1 Hz

VOLTAGE OUTPUT

SWITCHED 12 V (BATTERY)⁸

One output provides unregulated 12 V (battery voltage) source under program control. Thermal fuse hold current = 670 mA @ -40°C, 500 mA @ 20°C, 290 mA @ 70°C.

0.15 TO 5 V ANALOG OUTPUTS (VX1, VX2)⁹

Two terminals configured for 150 to 5000 mV continuous analog output or voltage excitation using 12-bit Dac.

Range	Resolution	Maximum Source/Sink Current
150 to +5000 mV	4.5 mV	50 mA total, concurrent or individually

COMMUNICATIONS

INTERNET PROTOCOLS: PPP, ICMP/Ping, Auto-IP(APIPA), IPV4, IPV6, UDP, TCP, TLS, DHCP Client, SLAAC, DNS Client, Telnet

ADDITIONAL PROTOCOLS SUPPORTED: PakBus, SDI-12, Modbus RTU, Modbus ASCII, Modbus TCP/IP, DNP3. Custom user-definable over serial

DATA FILE FORMATS: CSV, XML, JSON, binary, encrypted

USB: USB micro-B device only, 2.0 full-speed 12 Mbps, for computer connection.

RS-232: female RS-232, 9-pin interface

SERIAL (C1, C2): 0 to 5 V output, 3.3 V input, 1200 to 115.2k bps

SDI-12 (C1, C2): Two independent SDI-12 V1.3 compliant terminals configurable as sensor or recorder

SYSTEM

PROCESSOR: ARM Cortex M4 running at 144 MHz

MEMORY

CPU DRIVE / PROGRAMS: 5 MB flash
DATA: 10 MB flash
OPERATING SYSTEM (OS): 2 MB flash

CLOCK ACCURACY: ±1 min. per month

CLOCK RESOLUTION: 1 ms

PROGRAM EXECUTION: 100 ms to one day

POWER REQUIREMENTS

CHARGER INPUT (CHG): 16 to 32 Vdc, current limited at 0.9 A.
Power converter or solar panel input.

EXTERNAL BATTERIES (BAT): 12 Vdc, lead-acid 7 Ah battery, typical

INTERNAL LITHIUM BATTERY: 3 V coin cell CR2016 (Energizer) for battery-backed clock. 6 year life with no external power source.

TYPICAL POWER REQUIREMENTS

SLEEP: 1.5 mA
ACTIVE 1 HZ SCAN WITH ANALOG MEASUREMENTS: 5 mA

USB POWER (USB): For programming and limited functionality.

COMPLIANCE

CE: All terminals tested to Class 4 levels (IEC 61000-4-5: 2013) for surge and (IEC 61000-4-2:2008) for ESD

SHOCK AND VIBRATION: ASTM D4169-09

PROTECTION: IP30

PHYSICAL

DIMENSIONS: 14.0 X 7.6 X 5.1 cm (5.5 x 3.0 x 2.0 in); additional clearance required for cables and leads

WEIGHT/MASS: 242 g (8.5 oz)

MATERIAL

CASE: Powder-coated aluminum

WARRANTY

Three years against defects in materials and workmanship.

⁶ Requires an external 100 kΩ resistor connected from the terminal to BAT+.

⁷ AC coupling removes ac offsets up to ±0.05 V.

⁸ Not operational under USB power only.

⁹ Range reduced to 0 to 2500 mV when under USB power.

TERMINAL FUNCTIONS

Each terminal may only take on one function.

Analog Input Function	C1	C2	P_SW	P_LL	VX1	VX2	SE1	SE2	SE3	SE4	SE5	SE6	RS-232	SW12	Max
Single Ended							✓	✓	✓	✓	✓	✓			6
Differential							H	L	H	L	H	L			3
4 to 20 or 0 to 20 mA							✓	✓							2
Analog Output Function	C1	C2	P_SW	P_LL	VX1	VX2	SE1	SE2	SE3	SE4	SE5	SE6	RS-232	SW12	Max
Switched-Voltage Excitation					✓	✓									2
5 V Source	✓	✓			✓	✓									4
12 V Source														✓	1
Digital I/O Function	C1	C2	P_SW	P_LL	VX1	VX2	SE1	SE2	SE3	SE4	SE5	SE6	RS-232	SW12	Max
RS-232													✓		1
RS-232 TTL	Tx	Rx													1
SDI-12	✓	✓													2
Pulse-Width Modulation							✓	✓	✓	✓					6
Timer Input							✓	✓	✓	✓					6
Period Average							✓	✓	✓	✓					4
Interrupt	✓	✓					✓	✓	✓	✓					6
General I/O	✓	✓	✓				✓	✓	✓	✓					7
Pulse Counting Function	C1	C2	P_SW	P_LL	VX1	VX2	SE1	SE2	SE3	SE4	SE5	SE6	RS-232	SW12	Max
Switch Closure	✓	✓	✓												3
High Frequency	✓	✓	✓	✓			✓	✓	✓	✓					8
Low Level AC				✓											1