

# CR7 Specifications

Electrical specifications are valid for over a -25° to +50°C range unless otherwise specified.

## Analog Inputs

(723T or 723 Card specifications below;

726 ±50 V Card specifications discussed in System Description)

**Voltage Measurement Types:** Single-ended or differential.

**Range and Resolution:** Ranges are software selectable on any input channel.

Input Range (mV)	Resolution	
	Differential	Single-ended
±5000	166 $\mu$ V	333 $\mu$ V
±1500	50 $\mu$ V	100 $\mu$ V
±500	16.6 $\mu$ V	33.3 $\mu$ V
±150	5 $\mu$ V	10 $\mu$ V
±50	1.66 $\mu$ V	3.33 $\mu$ V
±15	500 nV	1000 nV
±5	166 nV	333 nV
±1.5	50 nV	100 nV

### Accuracy of Voltage Measurements:

Differential: ±0.02% FSR (±0.01%, 0-40°C)  
(e.g. ±0.02% FSR = ±2.0 mV for ±5 V range)

Positive single-ended: ±0.02% FSR  
(±0.01%, 0-40°C) ±5  $\mu$ V

Negative single-ended: ±0.03% FSR  
(±0.015%, 0-40°C) ±5  $\mu$ V

**Input Sample Rates:** Fast A/D conversions are integrated over 250  $\mu$ s. Slow A/D conversions are integrated over 16.67 ms for 60 Hz AC rejection or optionally, 20.0 ms for 50 Hz AC rejection. Differential measurements include two conversions, one with reversed input polarity, to reduce thermal offset and common mode errors. The following intervals do not include the self-calibration measurement which occurs once per instruction.

	Input sample rates ms/channel	Typical input noise nV/RMS
Fast Single-ended	2.9	350
Fast Differential	4.7	250
Slow Single-ended	22.0	43
Slow Differential	43.0	30
Fast Differential (TC)	7.9	250

**Common Mode Range:** ±5 V

**Common Mode Rejection:** > 140 dB (DC to 100 Hz)

**Normal Mode Rejection:** 70 dB (60 Hz with slow differential measurement)

**Input Current:** 100 pA max

**Input Current Noise:** 9 pA RMS (slow differential)

**Input Resistance:** 2.5 G $\Omega$  typical

**Sustained Input Voltage without Damage:**  
≤ ±16 VDC

## Pulse Counters

(724 Card)

**Pulse Counters per Card:** 4

**Maximum Counts per Interval:** 32,767 (with overrange detection)

**Modes:** Programmable modes are switch closure, high frequency pulse, and low level AC.

### Switch Closure Mode

Minimum Switch Closed Time: 1 ms

Minimum Switch Open Time: 4 ms

Maximum Bounce Time: 1.4 ms open without being counted.

## High Frequency Pulse Mode

Minimum Pulse Width: 2  $\mu$ s

Maximum Input Frequency: 250 kHz

Voltage Thresholds: The count is incremented when the input voltage changes from below 1.5 V to above 3.5 V.

Maximum Input Voltage: ±20 V

## Low Level AC Mode

This mode is used for counting the frequency of low voltage, sine wave signals.

Input Hysteresis: 11 mV

Maximum AC Input Voltage (RMS): 20 V

Frequency Range:

Minimum AC Input Voltage (mV RMS)	Range (Hz)
15	1 to 100
25	1 to 1,000
50	1 to 3,000
160	1 to 10,000

## Digital Control Outputs

(725 Card)

Each card includes 8 digital control outputs.

### Output Voltages (no load):

High: 5.0 V ±0.1 V

Low: < 0.1 V

**Output Resistance:** 400  $\Omega$

## Analog Outputs

(725 Card)

Each card contains 8 switched and 2 continuous analog outputs.

**Switched:** Provides a precision voltage for resistance measurement, then switches off (high impedance). Only one switched output can be active at a time.

**Continuous:** A preset voltage is held until updated. Voltage degrades 0.17 mV every 7 seconds. All continuous analog outputs (and digital control ports) can be active simultaneously.

**Range:** ±5 V

**Resolution:** 166  $\mu$ V

**Accuracy:** Same as voltage measurements.

**Output Current:** 25 mA at ±5 V, 50 mA at ±2 V

## Resistance and Conductivity Measurements

(Combination of 723 and 725 Cards)

**Accuracy:** ±0.01% of full scale bridge output provided the matching bridge resistors are not the limiting factor.

**Measurement Types:** 6-wire and 4-wire full bridge, 4-wire, 3-wire, and 2-wire half bridges. High accuracy, low impedance bridge measurements are made ratiometrically with dual polarity measurements of excitation and output to eliminate thermal emfs. AC resistance and conductivity measurements use a 750  $\mu$ s excitation pulse with the signal integration occurring over the last 250  $\mu$ s. An equal duration pulse of opposite polarity is applied for ionic depolarization.

## Transient Protection

All input and output connections to the I/O Module are protected using spark gaps that are rated to 10,000 A. The spark gaps are connected directly to a heavy copper bar on each input card with no more than 2 inches of 20 AWG copper wire.

## Control Module

**Processor:** Hitachi 6303

**Memory:** 24K ROM; 40K RAM, 709 Card provides an additional 512K RAM.

**Data Storage:** 18.8K values, standard; 280K values, expanded.

**Display:** 8 digit LCD (0.5" digits).

**Peripheral Interface:** 9-pin, D-type connector on the Control Module panel for connection to storage module, card storage module, multidrop interface, modem, printer, or RS-232 adapter. Baud rates selectable at 300, 1200, 9600, and 76,800.

**I/O Module Interface:** Optically isolated current loops allow connection of up to 4 I/O Modules. I/O Modules can be separated from the Control Module by up to 1,000 feet.

**Clock Accuracy:** ±1 minute per month.

**Maximum Program Execution Rate:** System tasks can be initiated in sync with real-time up to 80 Hz.

## System Power Requirements

**Voltage:** 9.6 to 15 VDC

**Typical Current Drain:** 3.5 - 6 mA (minimum system) quiescent, 16 mA during processing, 100 mA during analog measurement.

**Internal Batteries:** Sealed rechargeable with 2.5 Ahr capacity per charge.

**Charging Circuit:** Requires DC or rectified AC voltage from 15 to 25 V. Thermal compensation is included to optimize charging voltage according to ambient temperature.

**External Batteries:** Any 12 V external battery can be a primary power source; internal batteries provide a backup while the external batteries are changed.

**Operation from AC Sources:** An AC operated battery charger is included with the enclosure to maintain full charge on the batteries where AC power is available. In the event of power failure, the internal batteries will keep the system operational for up to 5 days in most applications.

## Physical Specifications

**Size:** ENC 7L 17" x 12" x 6"  
ENC 7F 20" x 13" x 10"  
ENC 7XL 19" x 19" x 10"

**Weight:** ~40 lbs (ENC 7F with 700X, 720, & seven I/O cards).

## Warranty

Three years against defects in materials and workmanship.