# Quadrature Encoder Input Module for Compact FieldPoint

NI cFP-QUAD-510

- 4-axis quadrature encoder inputs
  - Differential or single-ended inputs
  - 5 to 30 VDC
- 32-bit position registers
- 16-bit velocity registers
- Onboard 5 V regulated power supply
- 2,300 V_{rms} bank isolation for transient overvoltage protection
- Hot-swappable with autoconfiguration
- -40 to 70 °C operating range
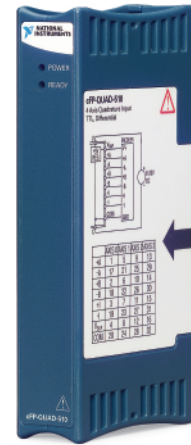
Module	Number of Quadrature Encoder Inputs	Position Resolution	Velocity Resolution	Lowpass Filter Cutoff	Voltage Inputs	Regulated Power Output
cFP-QUAD-510	4	32-bit	16-bit	250 kHz	5 to 30 VDC	5 V at 600 mA

Overview

The National Instruments cFP-QUAD-510 is a versatile quadrature encoder input module for Compact FieldPoint that you can use to directly measure position and velocity in a motion control application. This module can connect to differential and single-ended quadrature encoders with inputs between 5 and 30 VDC. It is commonly used in motion control applications with cFP-PWM-520 modules, Compact FieldPoint relay modules, cFP-PG-522 modules, or an external serial motor controller. The NI cFP-QUAD-510 includes onboard diagnostics to ensure trouble-free installation and maintenance.

Quadrature Encoder Input Module

The cFP-QUAD-510 accepts up to four channels of single-ended or differential quadrature encoder inputs and can measure position and velocity in both forward and reverse directions. The module also provides a regulated power supply to power 5 V encoders.

Position Operation

The module has four independent 32-bit position counters. You can easily accommodate encoders with various phase relationships by swapping the phase A and phase B signals. Each position counter has an index input. You can program the counter to reset when the index is turned on. The encoder can record frequencies as high as 1 MHz.

Velocity Operation

The cFP-QUAD-510 has four independent 16-bit velocity counters. The module returns the velocity as the number of counts per microsecond. A positive number indicates motion in the forward direction, and a negative number indicates motion in the reverse direction. There are eight selectable resolution ranges, so you can read the velocity average over a long period of time or read an instantaneous velocity reading.

Isolation

The cFP-QUAD-510 features optical bank isolation with 2,300 V_{rms} of breakdown isolation. It does not have channel-to-channel isolation.

Power Requirements

Because the cFP-QUAD-510 requires up to 1.2 W of power, it can limit the number of I/O modules that you can connect to a single network interface module. Controllers and network interface modules supply up to 9 W to power I/O modules.

Field I/O Connections

Compact FieldPoint modules include a built-in power distribution bus that provides multiple power connections on the modules. A field-wired power supply connected to the voltage (V) and common (C) terminals is internally regulated to 5 VDC and is connected to a power distribution bus that offers additional breakout terminals for voltage supply (+5 V) and common (COM). These terminals deliver a convenient way to distribute power to field devices that require external power.

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Quadrature Encoder Input Module for Compact FieldPoint

Each input channel on the cFP-QUAD-510 has eight terminals:

1. Encoder A+ input (A+)
2. Encoder A- input (A-)
3. Encoder B+ input (B+)
4. Encoder B- input (B-)
5. Encoder I+ input (I+)
6. Encoder I- input (I-)
7. Common (COM)
8. 5 VDC regulated power connection to power field devices (V_{SUP})
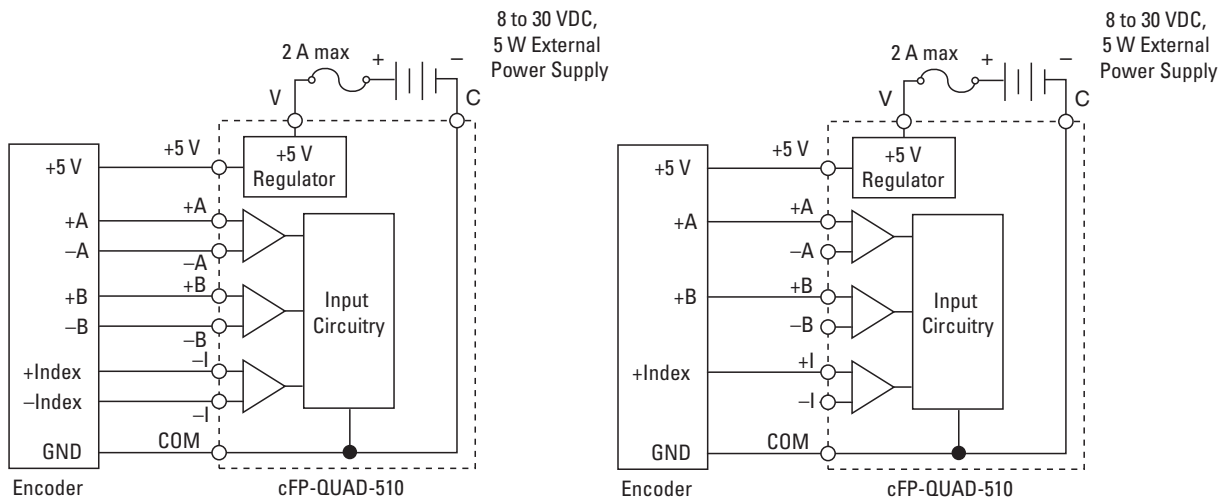
Wiring Schematics for the cFP-QUAD-510 Module

Specifications

Typical for -40 to 70 °C unless otherwise noted.

Encoder Input

Number of channels	4
Input type	
Single-ended.................................	$V_{IL} = 0$ to 0.8 V
	$V_{IH} = 2.0$ to 30.0 V
	(external pull up required)
Differential	
High	$(V_{IN-} + 0.3 \text{ V}) \leq V_{IN}+ \leq 30$ V
	$0 \text{ V} \leq V_{IN-} \leq 3.0$ V
Low	$(V_{IN+} + 0.3 \text{ V}) \leq V_{IN-} \leq 30.0$ V
	$0 \text{ V} \leq V_{IN+} \leq 3.0$ V
Maximum protected input voltage	±250 VDC on each input
Input bandwidth.................................	250 kHz for each input
Encoder frequency	1 million counts
Minimum input pulse width	2 µs
Counter widths..................................	32 bits, 4 billion counts
External supply voltage (V)	8 to 30 VDC at 5 W, user-provided
I/O supply voltage (V_{SUP})....................	5 VDC at 600 mA maximum
Maximum isolation voltage	250 V_{rms}, Installation Category II
Channel-to-channel isolation.............	No isolation between channels
Transient overvoltage.........................	2,300 V_{rms}

Physical Characteristics

LED indicators	Green POWER and READY indicators
Dimensions..	127.0 by 65.9 by 23.9 mm (5.00 by 2.60 by 0.94 in.)
Weight..	113 g (4.0 oz)

Environment

Operating temperature	-40 to 70 °C
Storage temperature..........................	-55 to 85 °C
Relative humidity	10 to 90%, noncondensing

Power Requirement

Power from network module	1.2 W maximum

Shock and Vibration

Operating vibration, random (IEC 60068-2-64)	10 to 500 Hz, 5 g_{rms}
Operating vibration, sinusoidal (IEC 60068-2-6)	10 to 500 Hz, 5 g
Operating shock (IEC 60068-2-27)	50 g, 3 ms half sine, 18 shocks at 6 orientations; 30 g, 11 ms half sine, 18 shocks at 6 orientations

Safety and Compliance

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note: For UL and other safety certifications, refer to the product label or visit **ni.com/certification**, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Minimum Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

Note: For EMC compliance, operate this device according to product documentation.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Note: Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit **ni.com/certification**, search by model number or product line, and click the appropriate link in the Certification column.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers: At the end of their life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit **ni.com/environment/weee.htm**.

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Hardware Services

NI Factory Installation Services

NI Factory Installation Services (FIS) is the fastest and easiest way to use your Compact FieldPoint systems right out of the box. Trained NI technicians install the software and hardware and configure the system to your specifications. NI extends the standard warranty by one year on hardware components (controllers, backplanes, modules) purchased with FIS. To use FIS, simply configure your system online with **ohm.ni.com/advisors/cfp**.

Calibration Services

NI recognizes the need to maintain properly calibrated devices for high-accuracy measurements. We provide manual calibration procedures, services to recalibrate your products, and automated calibration software specifically designed for use by metrology laboratories. Visit **ni.com/calibration**.

Repair and Extended Warranty

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