

Developing Monitoring and Control Systems with LabVIEW and CompactRIO

We all have a challenge to solve...



Power Distribution
and Control



Turbine Control



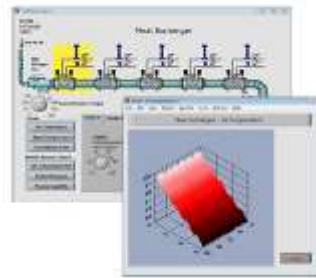
Industrial Machine
Control



Medical Device
Control



Structural
Monitoring



Process Control



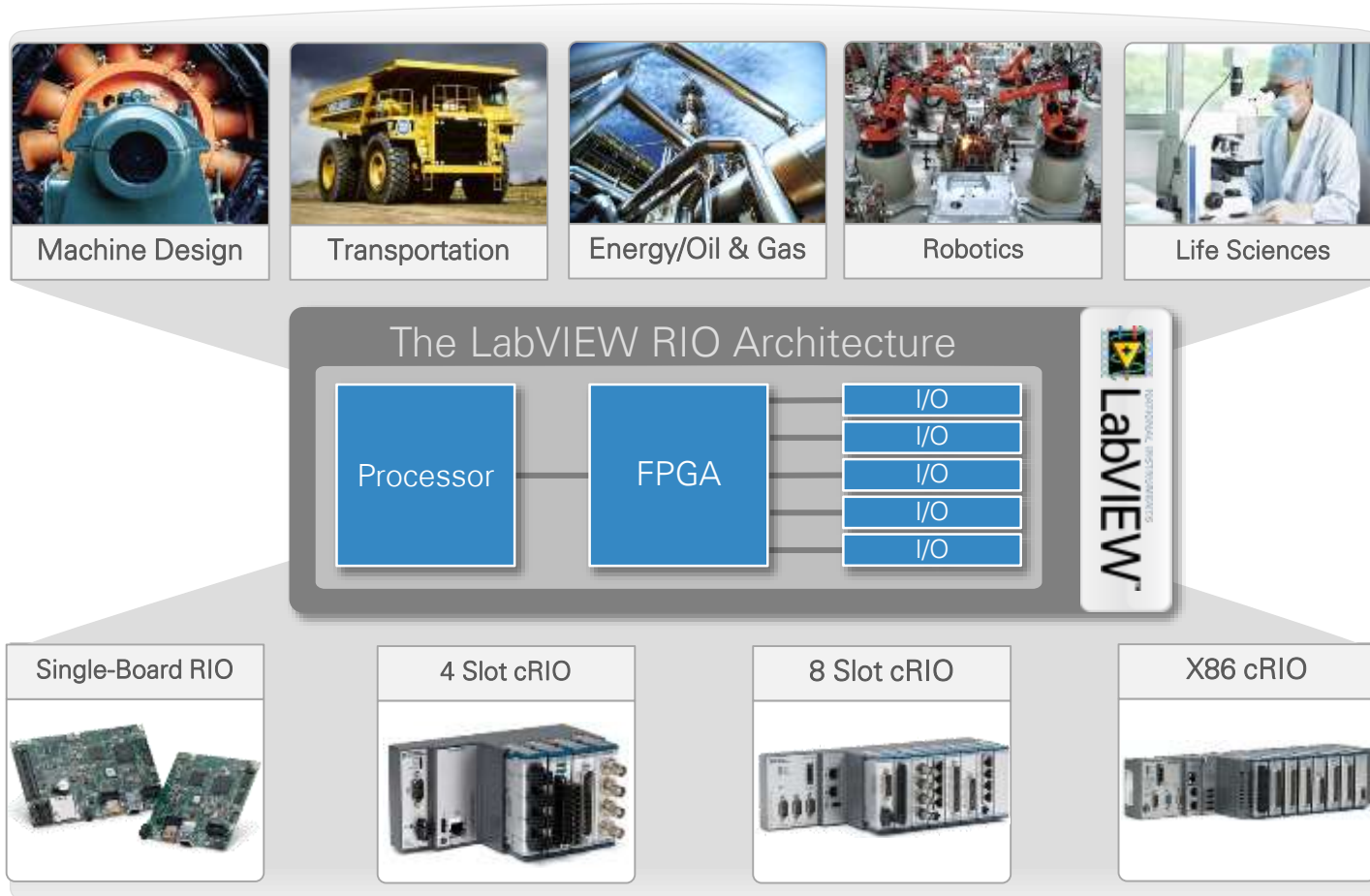
Oil and Gas
Applications



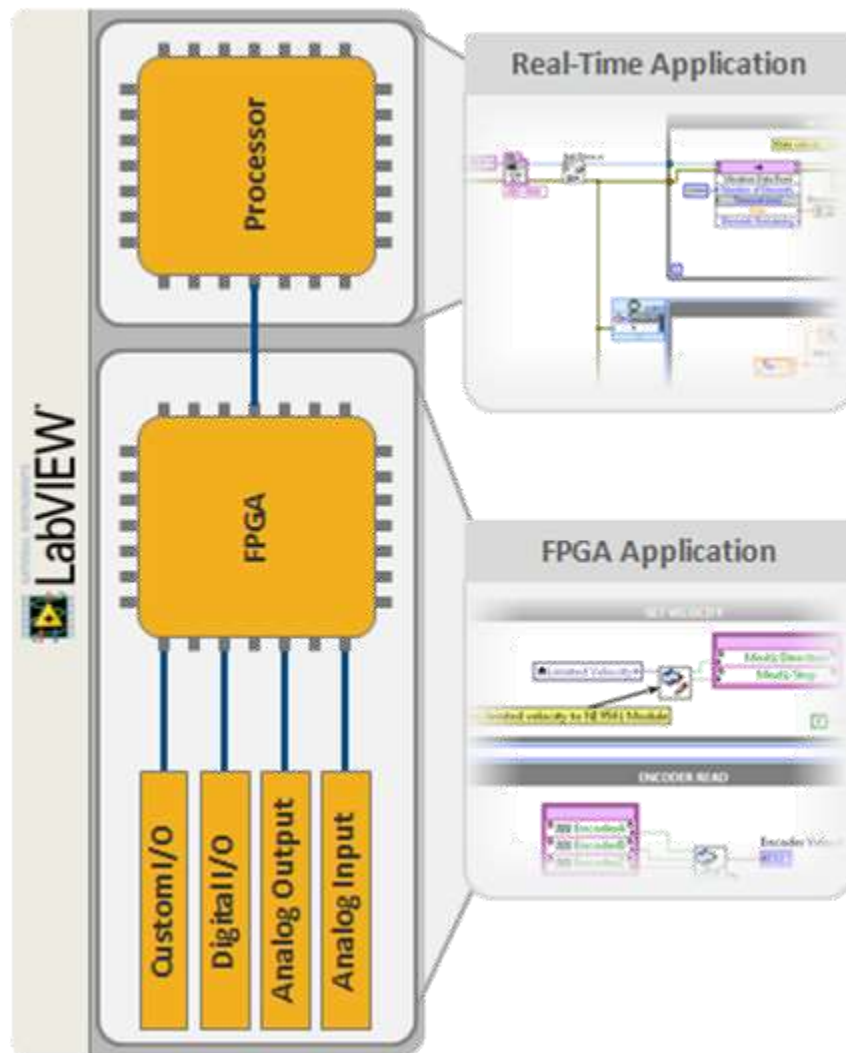
Power Monitoring
and Control

Graphical System Design

A platform-based approach for measurement and control



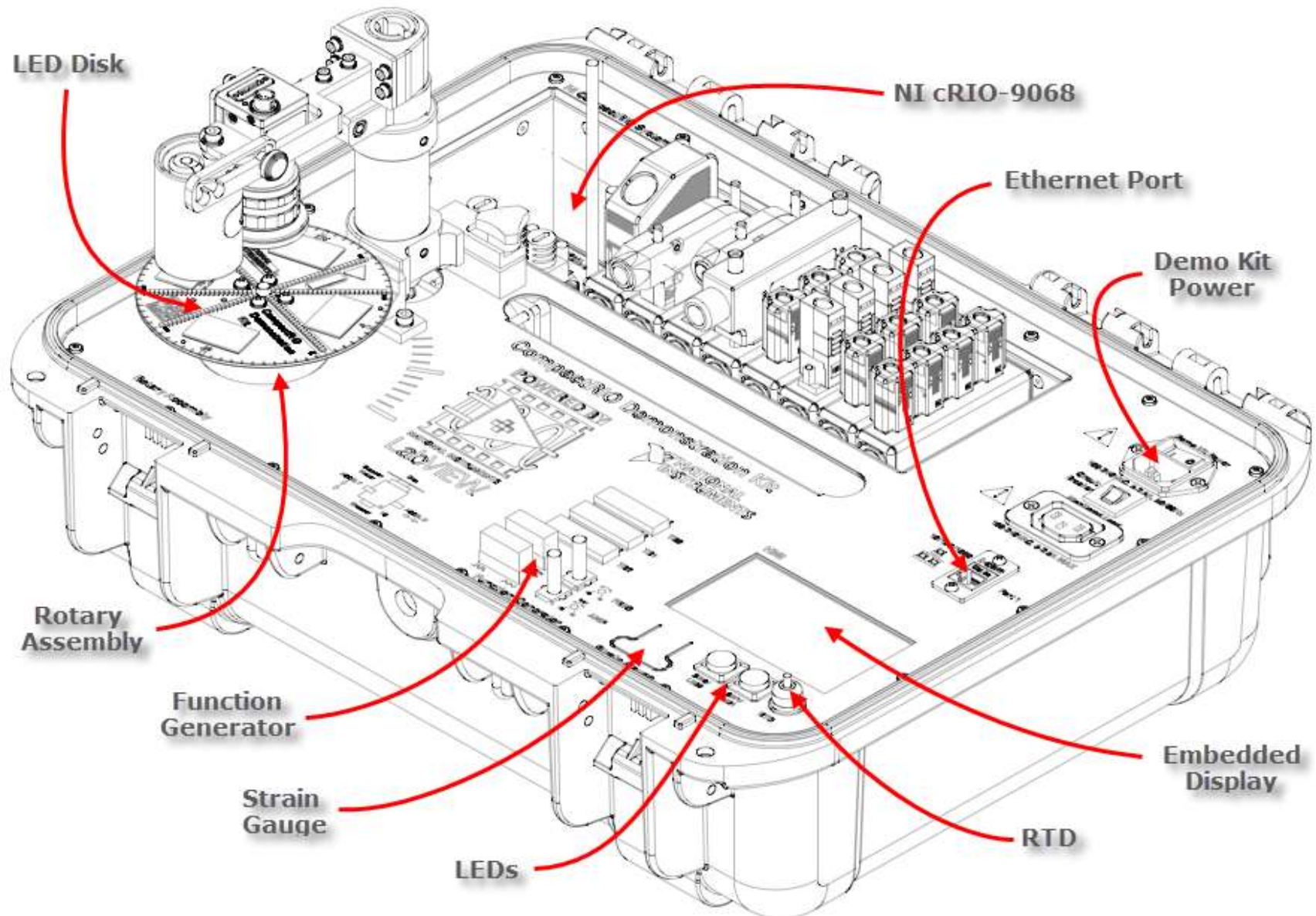
The LabVIEW RIO Architecture



- Real-time OS
- Application software
- Networking and peripheral I/O drives
- DMA, interrupt, and bus control drivers

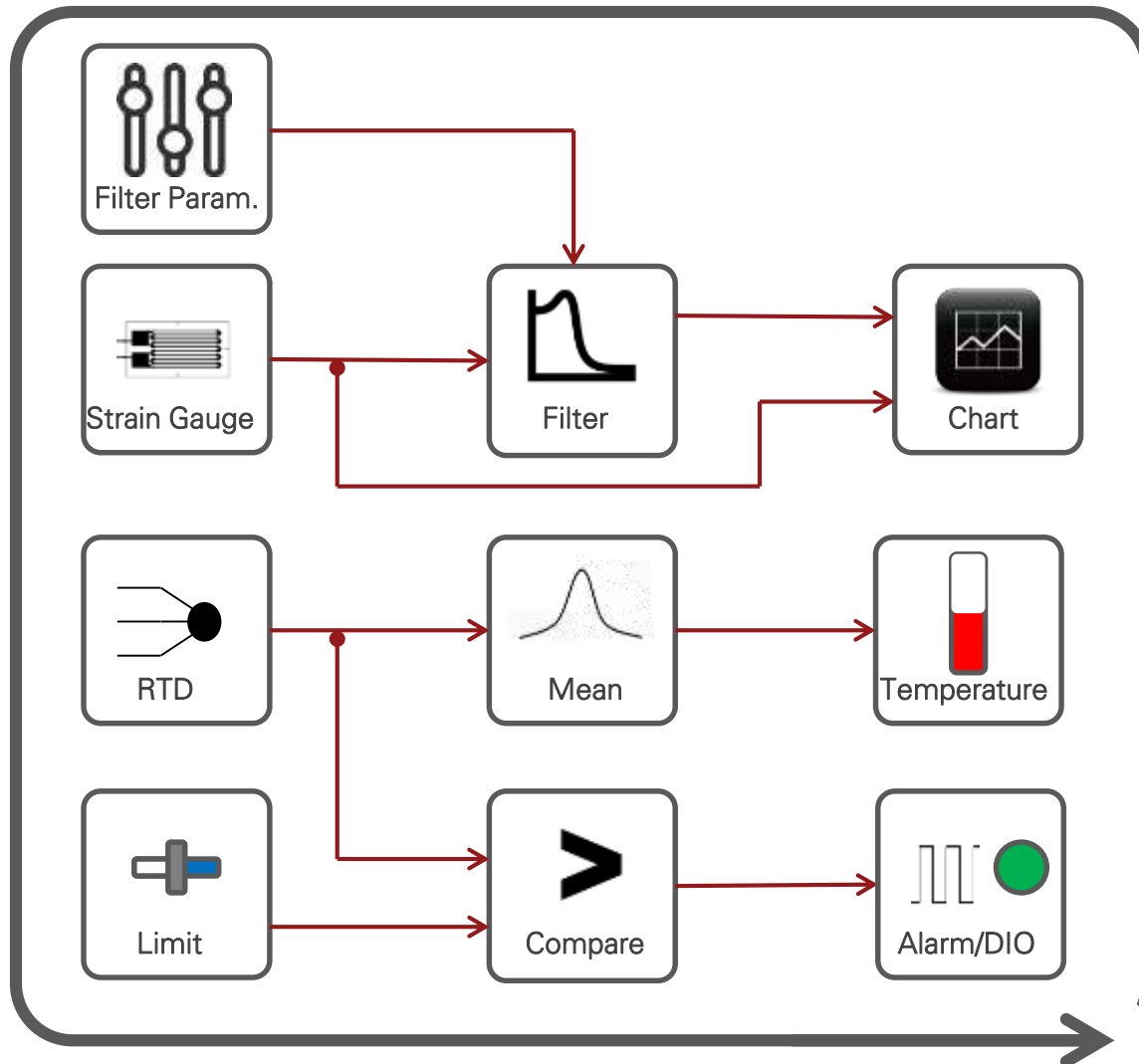
- Application IP
- Control IP
- DSP IP
- Specialized I/O drivers and interface
- DMA controller

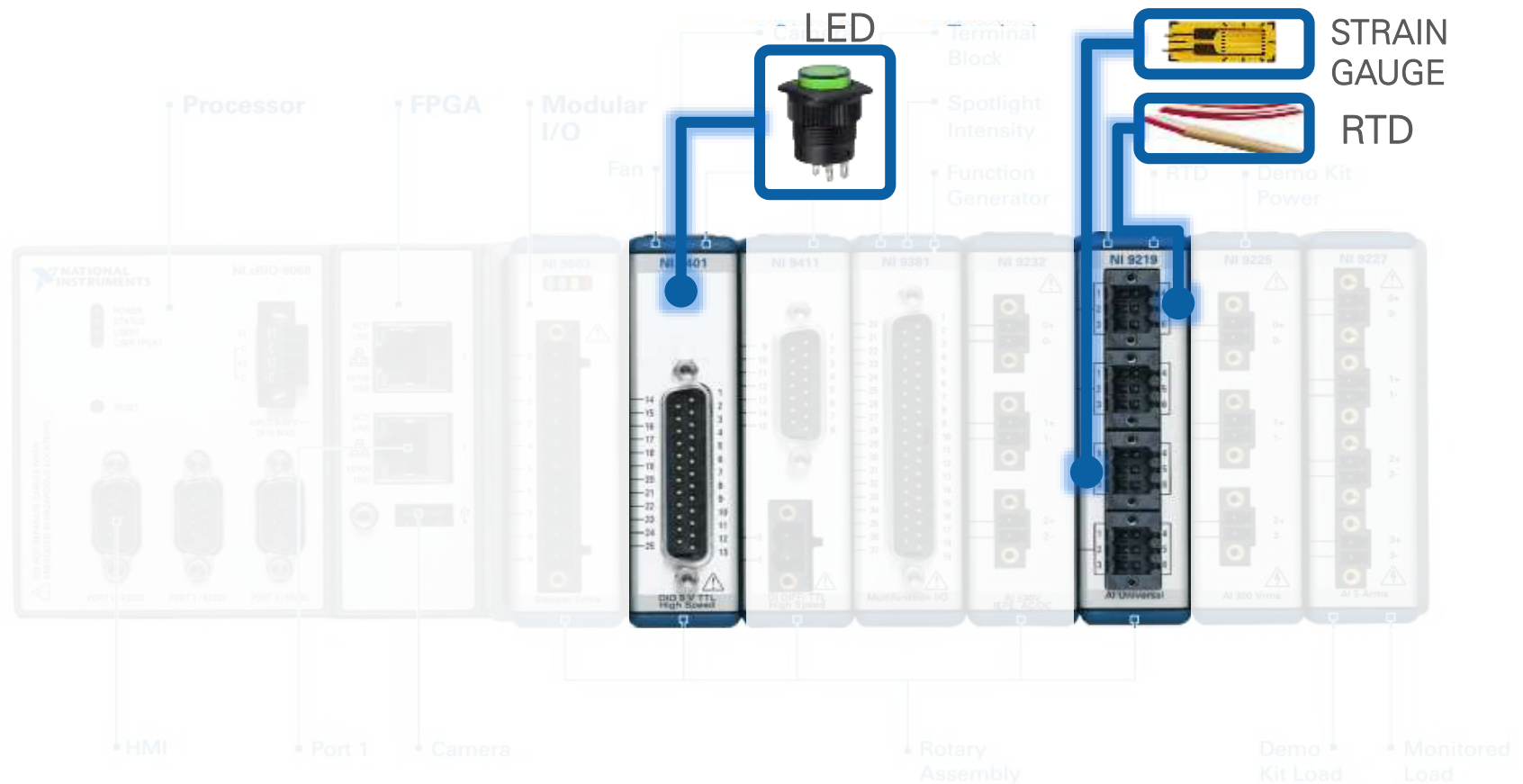
NI CompactRIO Demonstration Kit



Exercise 1

Temperature and Strain Monitoring





Inputs:

Slot 6: NI 9219—24 Bit Universal Analog Input
(4 DIFF · 100 S/s/ch)

Analog Input 0 (AI0) → RTD
(3 Wire Pt100-TCR3851)

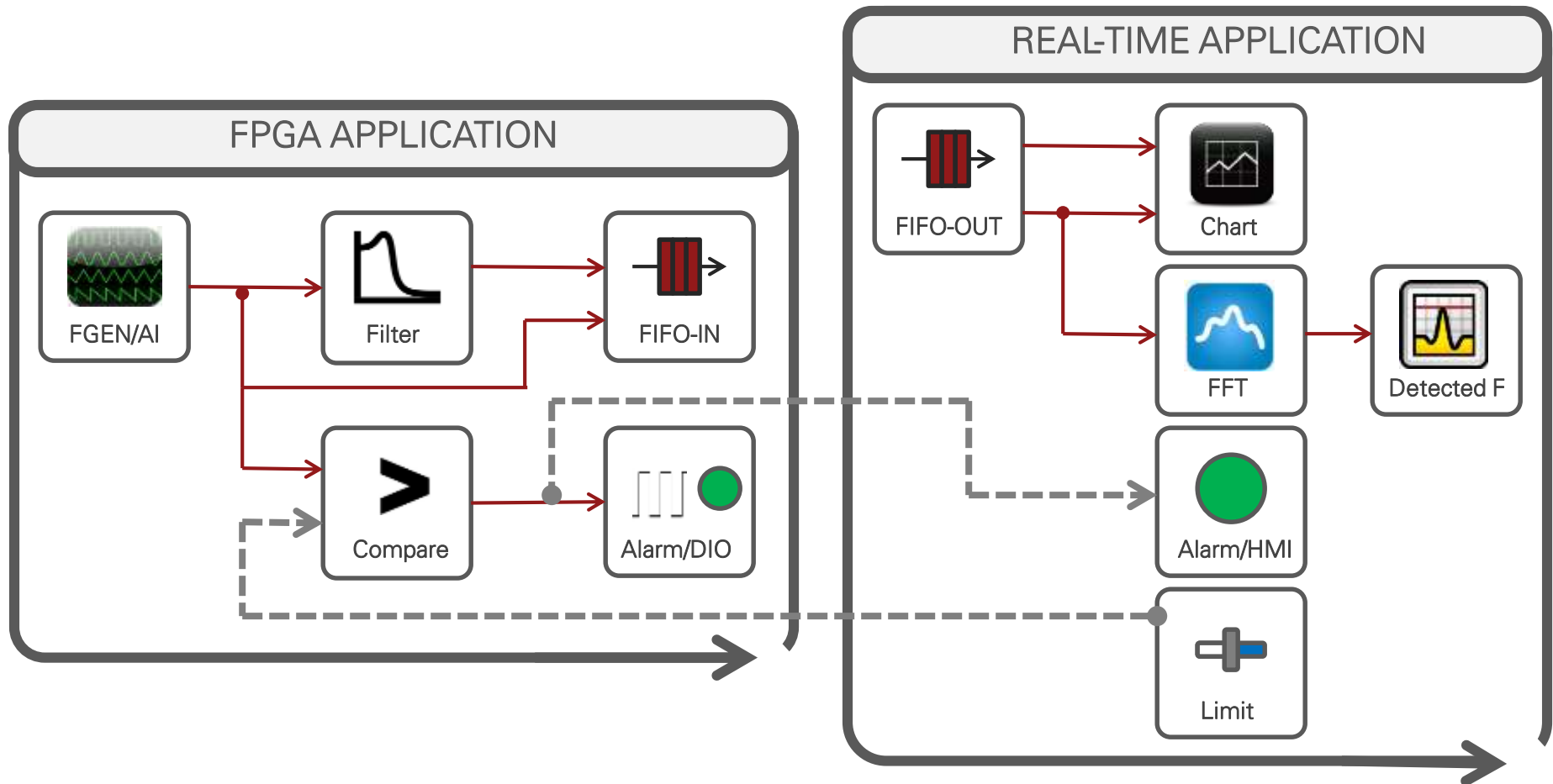
Analog Input 2 (AI2) → Strain Gauge
(Quarter Bridge / 350 Ohms)

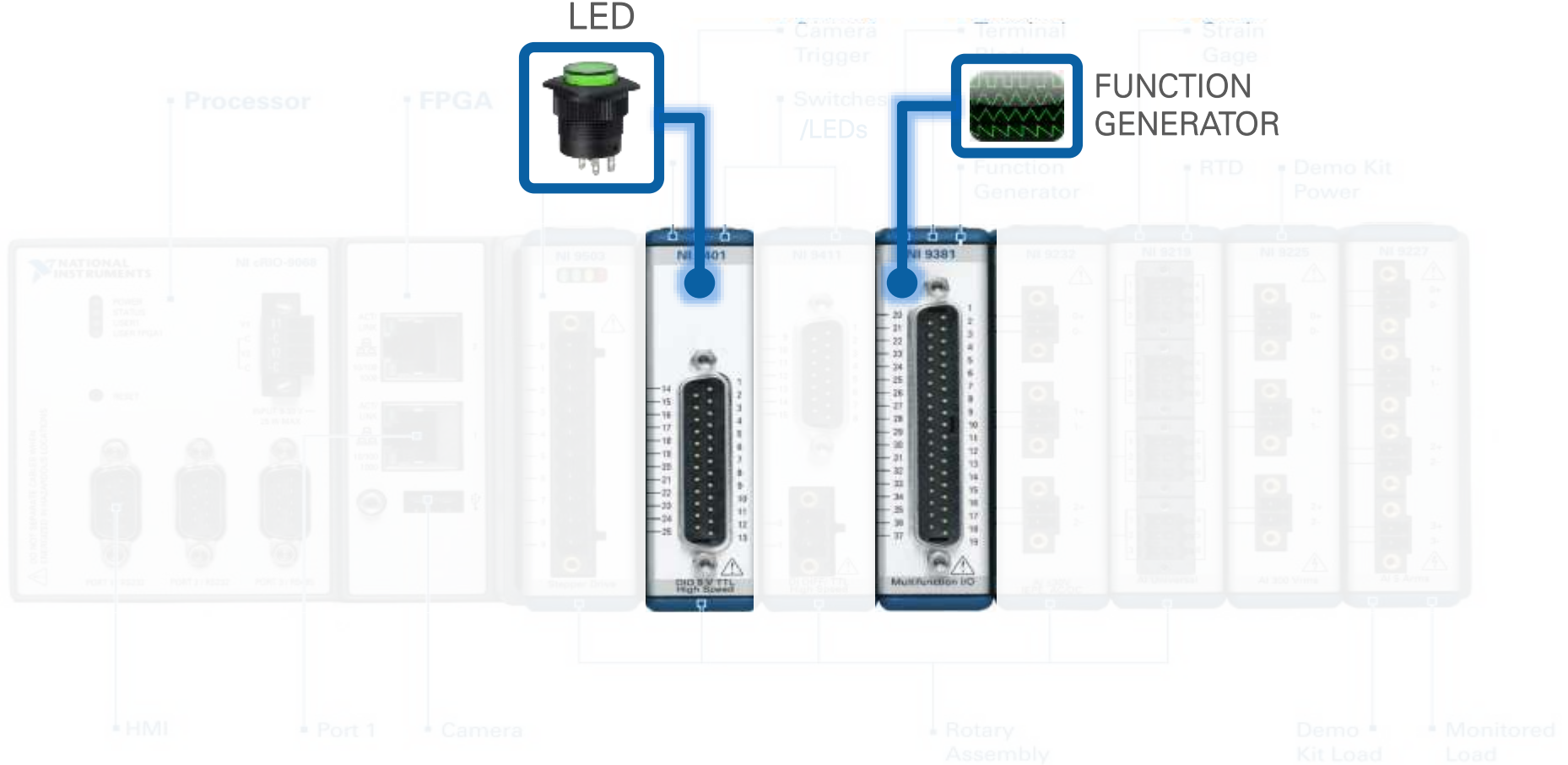
Outputs:

Slot 2: NI 9401—8 Ch, 5 V/TTL High-Speed
Bidirectional Digital I/O Module
Digital IO 5 (DIO5) → LED1

Exercise 2A

FPGA-Based Butterworth Filter





Inputs:

Slot 4: NI 9381— 0 V to 5 V AI/AO Module With 4 LVTTTL DIO Lines

Mod4/AI7→Function Generator

Sampling Period→ 20 kS/s

Resolution→12-bit

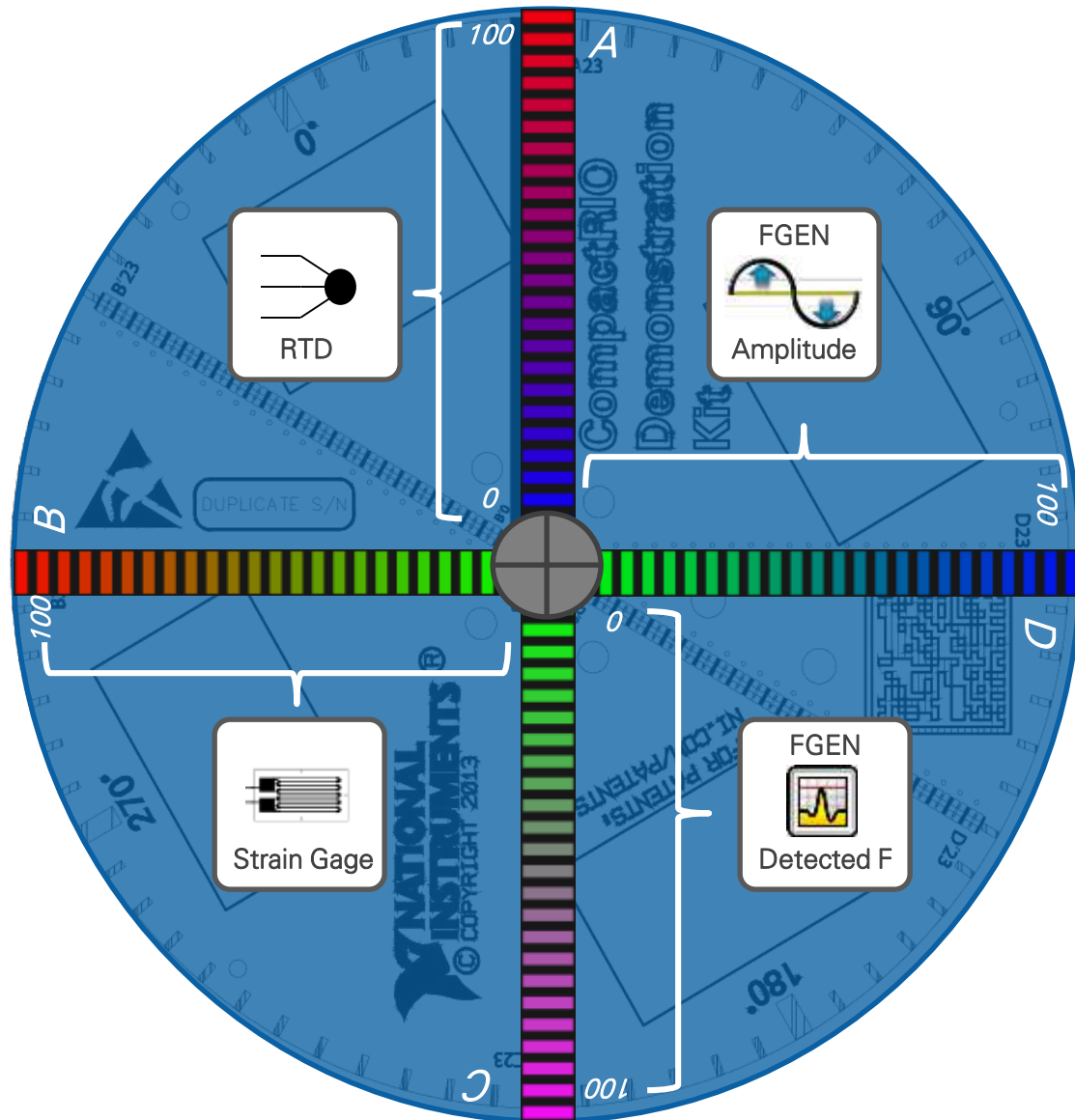
Outputs:

Slot 2: NI 9401— 8 Ch, 5 V/TTL High-Speed Bidirectional Digital I/O Module

Digital IO 4 (DIO4)→LED0

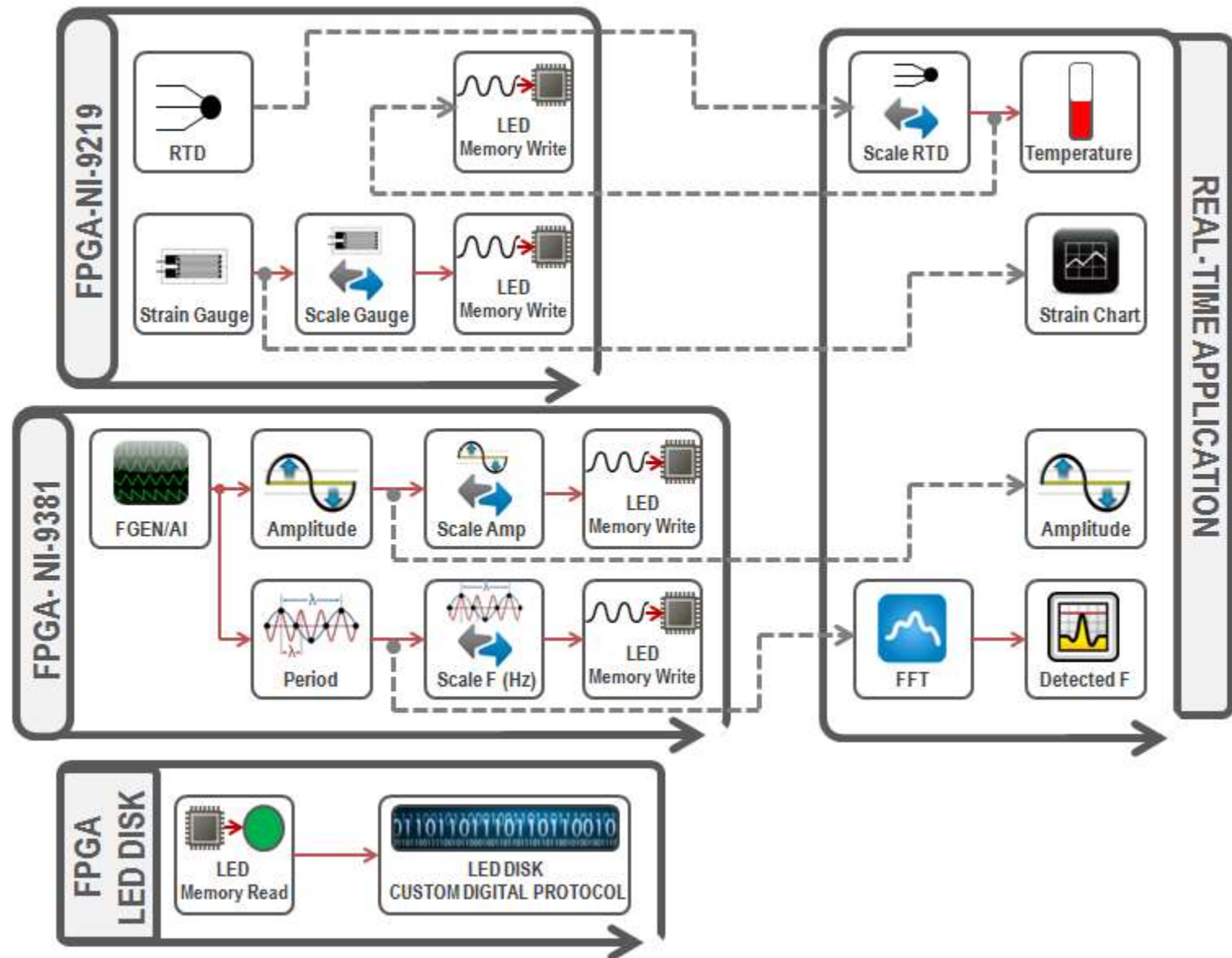
Exercise 2B

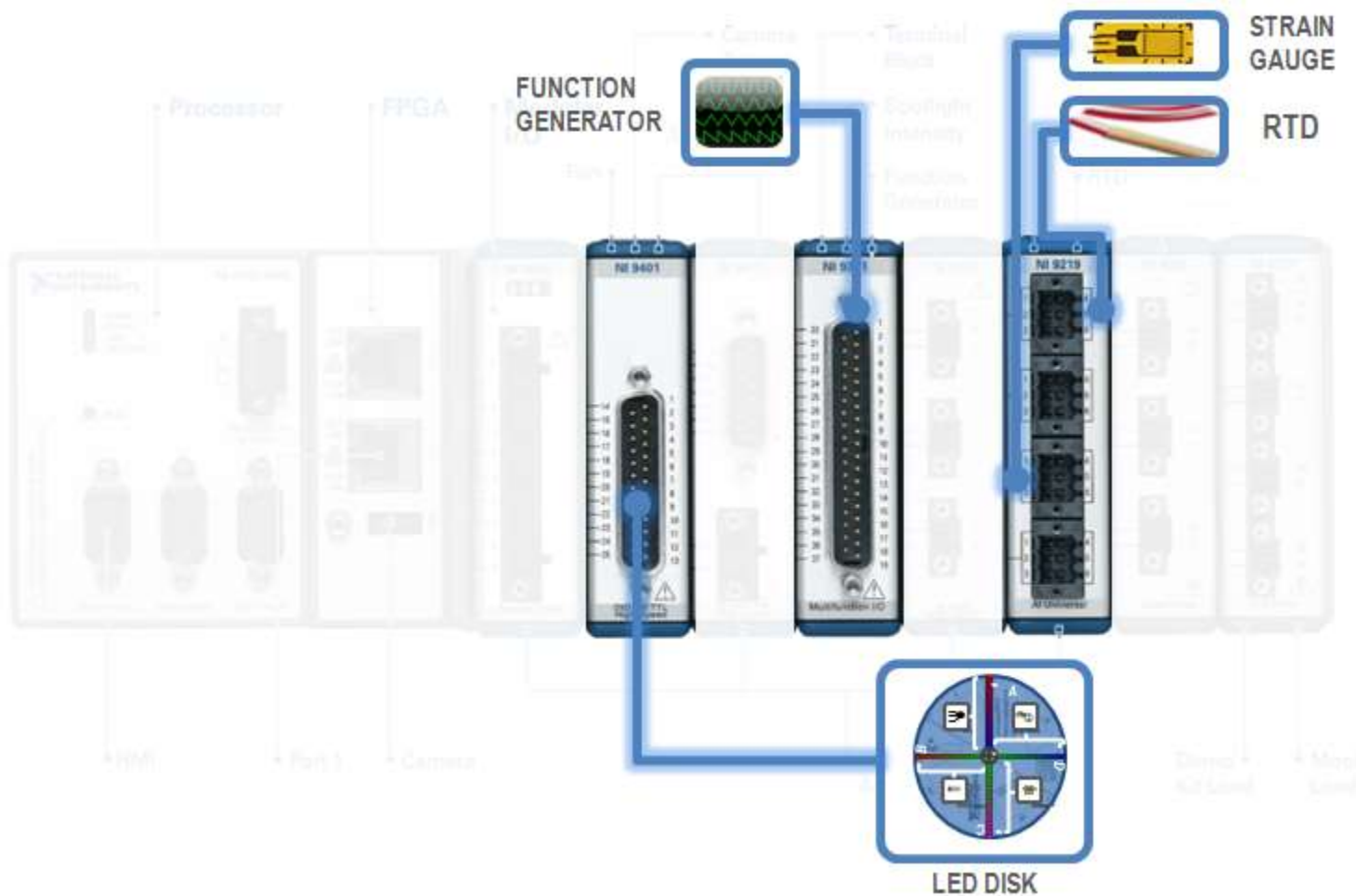
LED Array Display



Exercise 2B

LED Array Display





Inputs:

Slot 4: NI 9381— 0 V to 5 V AI/AO Module ($24\text{bits} \cdot 20\text{kS/s}$)
 Mod4/AI7→Function Generator

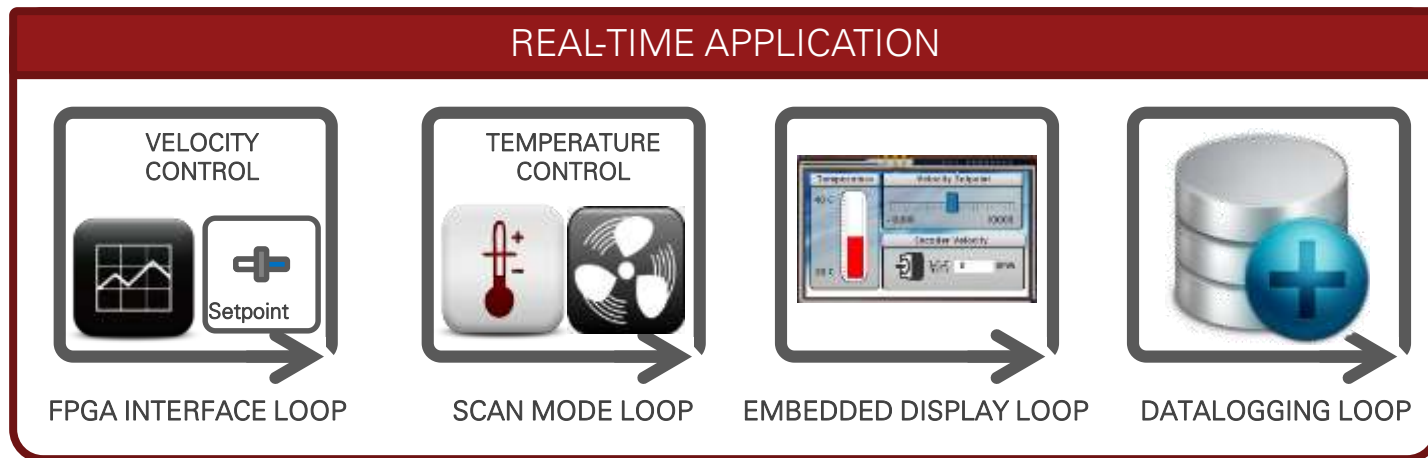
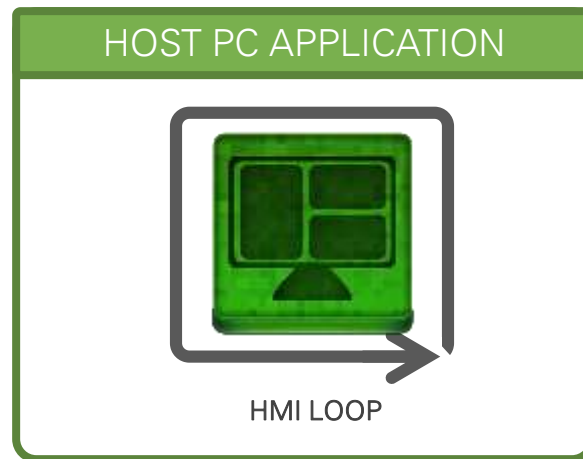
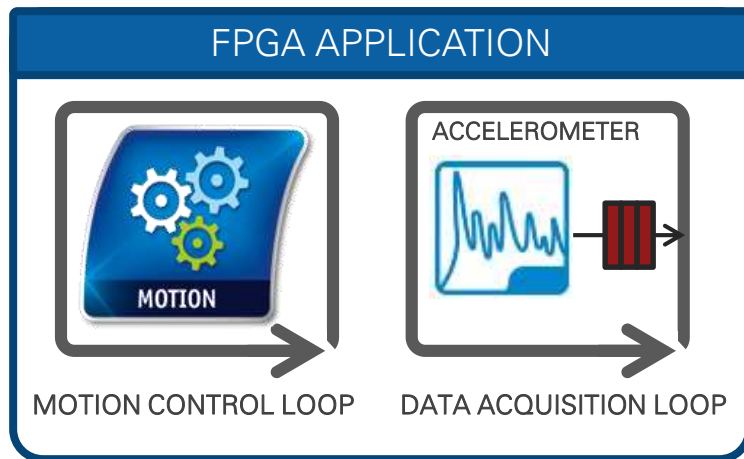
Slot 6: NI 9219— $24\text{ Bit Universal Analog Input}$
 ($4\text{ DIFF} \cdot 100\text{ S/s/ch}$)
 Analog Input 0 (AI0)→RTD (3 Wire Pt100-TCR3851)
 Analog Input 2 (AI2)→Strain Gauge
 (Quarter Bridge / 350 Ohms)

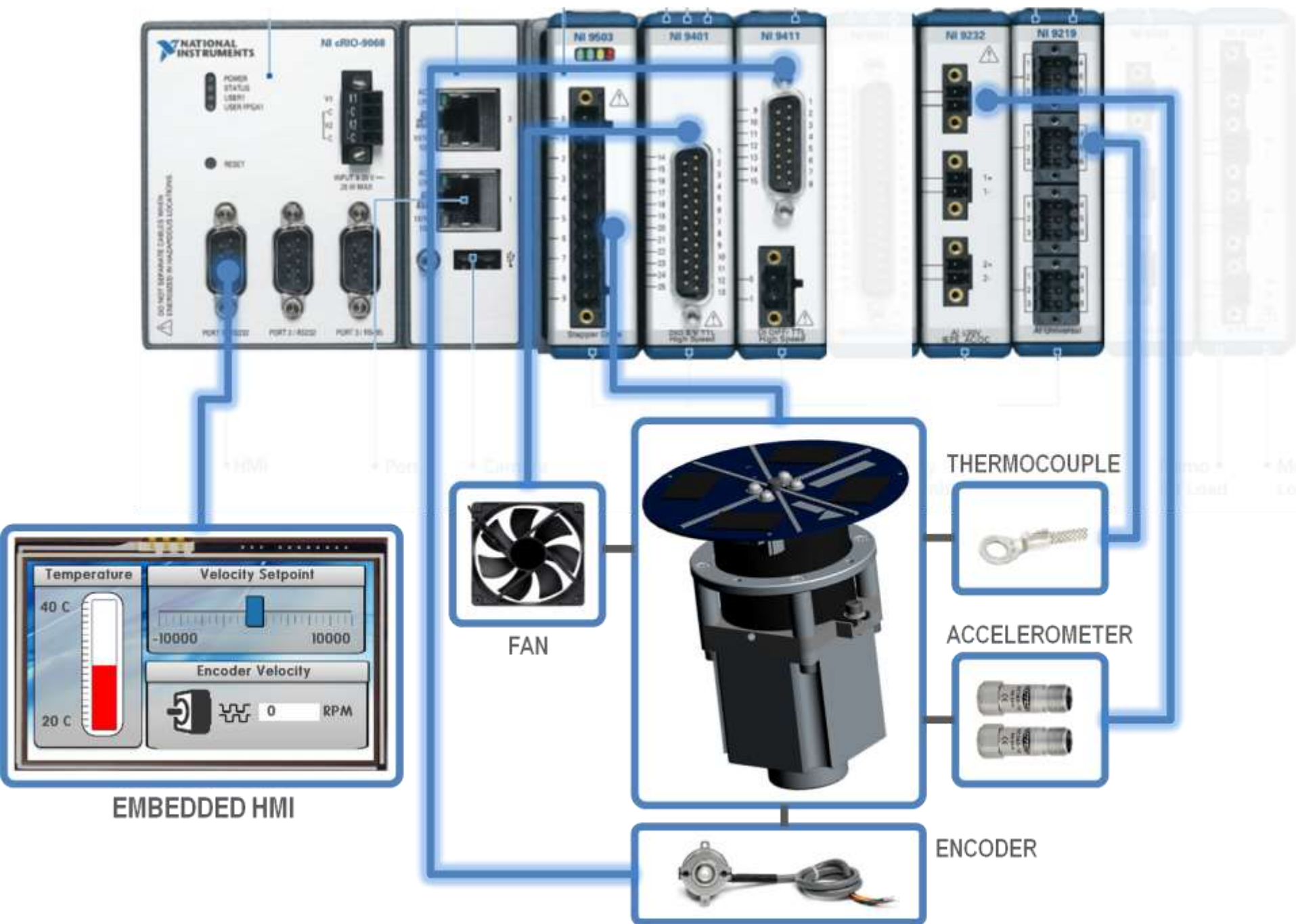
Outputs:

Slot 2: NI 9401— 8 Ch , 5 V/TTL High-Speed Bidirectional Digital I/O Module
 Digital IO 0 (DIO0)→SIN
 Digital IO 1 (DIO1)→SCLK
 Digital IO 2 (DIO2)→XLAT
 Digital IO 3 (DIO3)→BLANK

Exercise 3

Machine Condition Monitoring System





Exercise 3

Machine Condition Monitoring System

Inputs:

Slot 3: NI 9411— *6-Channel, 500 ns, ± 5 to 24 V Digital Input*

Mod3/DIO0→EncoderA

Mod3/DIO1→EncoderB

Mod3/DIO2→EncoderZ

Slot 5: NI 9234— *Dynamic Signal Acquisition Module*

Mod5/AI0→ACCEL X

Mod5/AI1→ACCEL1

Sampling Period→ 102.4 kS/s

Resolution→24-bit

Slot 6: NI 9219— *24 Bit Universal Analog Input*

Sampling Period→ 100 S/s/ch

Analog Input 1 (AI1)→TC (Type J / Celsius)

Outputs:

Slot 1: NI 9503— *C Series Stepper Drive with Antiresonance*

Axis 1→Mod1/Direction, Mod1/Step

Slot 2: NI 9401— *8 Ch, 5 V/TTL High-Speed Bidirectional Digital I/O Module*

Digital Output 7 (PWM7)→FAN

CompactRIO Developer's Guide

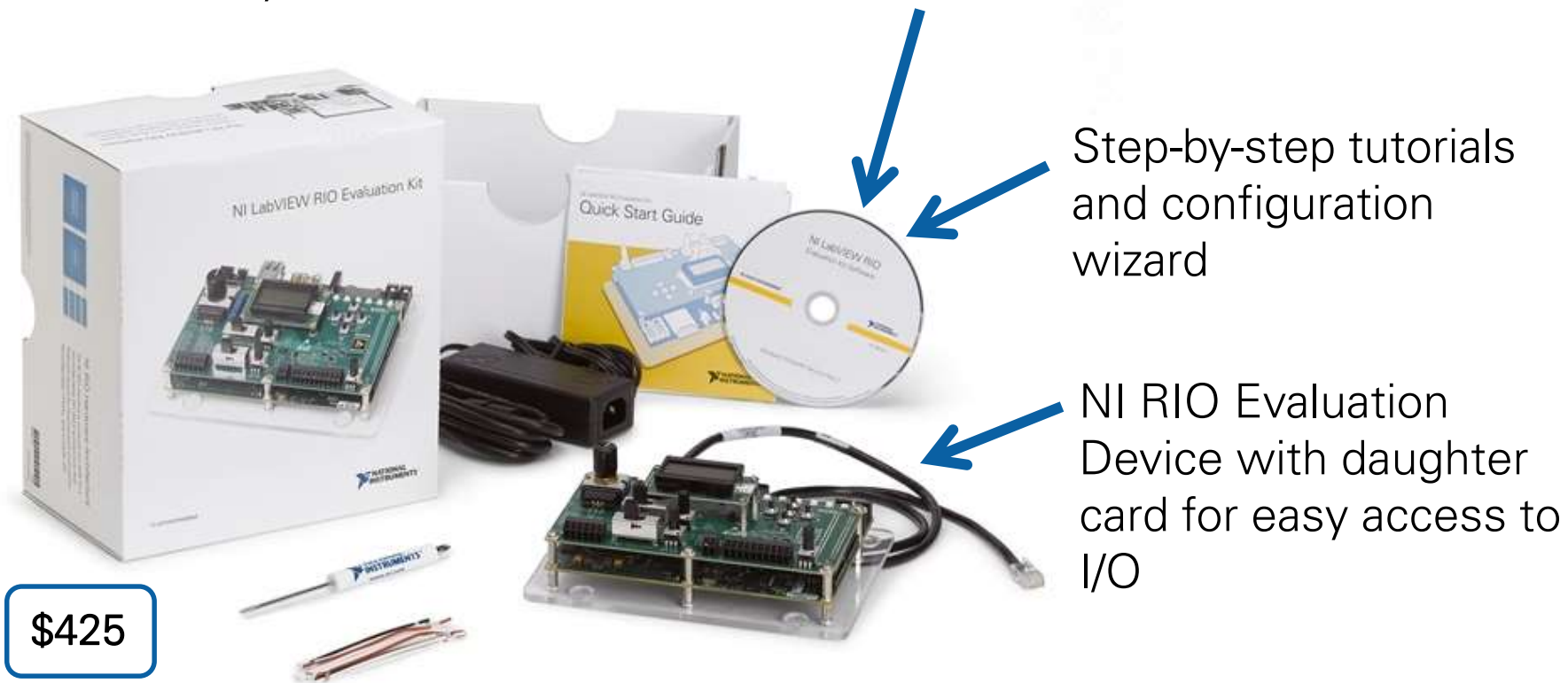
NI LabVIEW for CompactRIO Developer's Guide

Recommended LabVIEW Architectures and Development Practices
for Control and Monitoring Applications

<http://www.ni.com/compactriodevguide/>

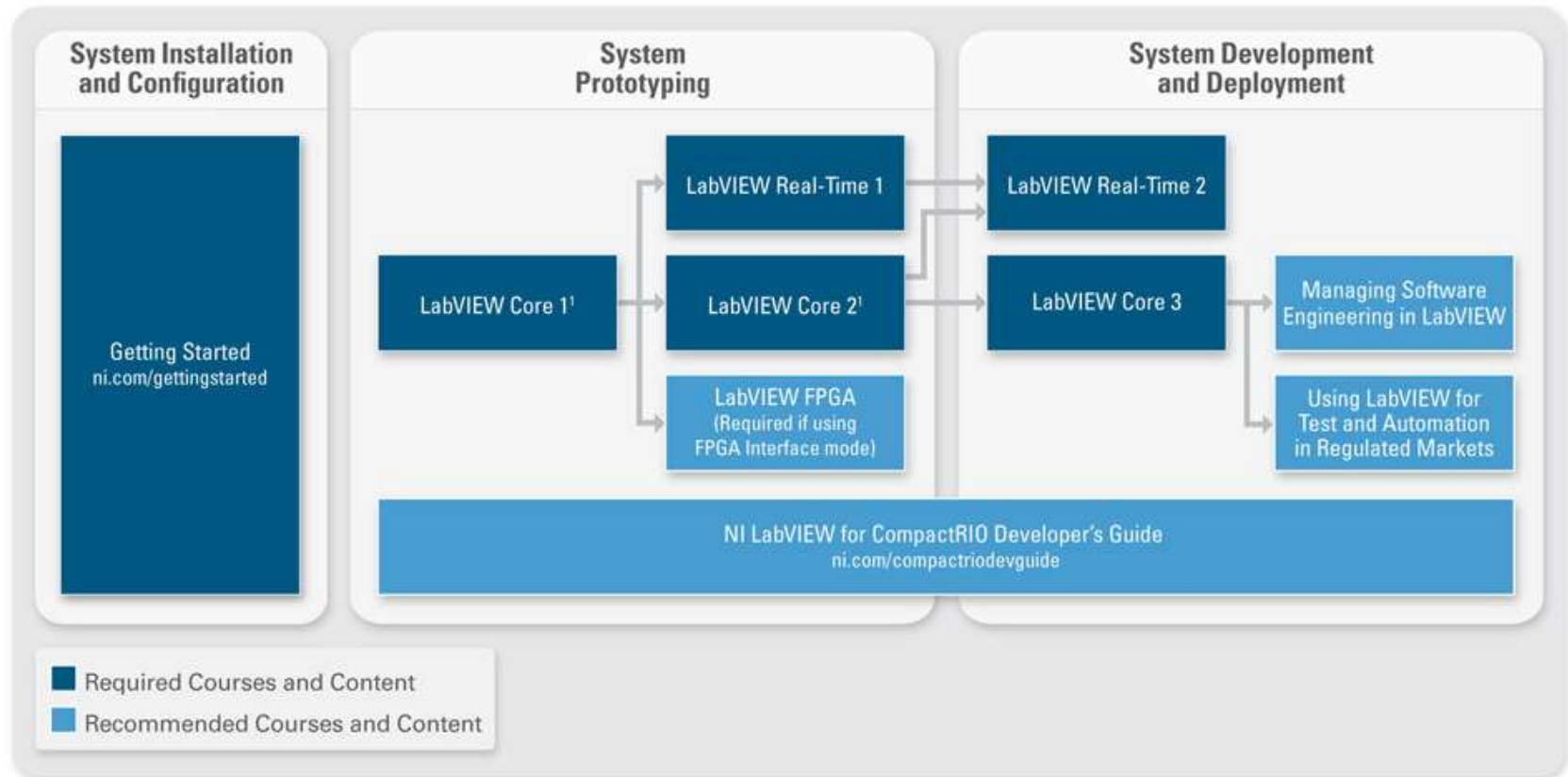
NI LabVIEW RIO Evaluation Kit

90-day LabVIEW, LabVIEW FPGA & LabVIEW Real-Time evaluation



Order at ni.com/rioeval
Online Community at ni.com/rioeval/nextstep

Training & Certification



¹ Since LabVIEW Core 1 and 2 fit into one week, you may choose to take both LabVIEW Core classes prior to LabVIEW FPGA and LabVIEW Real-Time 1.

ni.com/self-paced-training