

Spider-DAQ Specification (v1.00)

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Spider-DAQ Introduction

The Spider-DAQ builds on the proven outstanding performance and reliability of Crystal Instruments Spider platform and combines miniature-sized 8B isolated signal conditioning modules to provide a compact package for use in a wide range of rugged industrial applications.

The Spider-DAQ is a module that can be connected to the PC using an Ethernet connection or runs without a PC. Using various 8B modules, the Spider-DAQ can measure voltage, strain, current, frequency, temperature, and many more physical quantities. The Digital I/O can be used to interact with other devices, including environmental and temperature chambers.

Pluggable modules provide the system with maximum flexibility of analog and digital channel configuration, making it ideal for factory automation, process control, test and measurement, machine control, and data acquisition applications.

Modular design allows configuration with up to 16 input channels of isolated analog input, one analog output, and eight pairs of channels of isolated digital I/O.

With CI's unique Ethernet based time synchronization technology, multiple Spider-DAQs can be chained together to construct a system with thousands of input channels.

The powerful software functions of Spider-DAQ can be further utilized with its advanced alarm features. Four alarm states – high, high-high, low, and low-low – to be set on the analog input and digital I/O special function channels with alarm output mapped to a user selectable analog or digital output channel.

Each Spider module has its own mass storage media that houses the operating software and stores measurement data. This truly distributed system guarantees data recording at full speed without being subject to network speed limitations.

The Spider-DAQ system is available in a rack-mounted or bench top 1U enclosure.



Simple Network Connection

Ethernet connectivity allows the Spider-DAQ to be physically located far from the host PC and near the test article. This distributed structure greatly reduces the noise and electrical interference in the system. One PC can monitor and control multiple Spider-DAQ over the network. Since all the processing and data recordings are executed locally inside the Spider-DAQ, the network connection will not affect the measurement results. With wireless network routers, the PC can easily connect to the Spider remotely via Wi-Fi.

Time Synchronization between Multiple Modules

The Spider-DAQ is built on IEEE 1588 time synchronization technology. Spider modules on the same network can be synchronized with up to 100 ns accuracy, which guarantees ± 1 degree cross channel phase match up to 20 kHz. With such unique technology and high-speed Ethernet data transfer, the distributed components on the network truly act as one integrated system.

Black Box Mode: Run without PC

The Spider-DAQ can be run in *Black Box mode*, which allows it to operate without a PC. In this mode, a PC is used only to configure the DAQ system before the system starts operation and to download data after the test is complete. During the test, the system can be operated according to a preset schedule or from a variety of external devices, a Wi-Fi enabled PDA, or iPad.

Spider-DAQ Hardware Specification

Input Channel Specifications

- Input Channels:** up to 16 channels per module; up to 1,024 channels with 64 modules synchronized
- Connector Type:** Pluggable screw terminal
- Others: Vary in different 8B module. Refer to Dataforth SLX300 data sheet
- A/D Resolution:** 24 bit
- Sampling Rate per channel:** 0.48 Hz to 102.4 kHz, with 54 stages
- Maximum Useful Bandwidth:** 46% of sampling rate
- Crosstalk:** less than -100 dB
- Frequency Accuracy:** better than 1/100,000
- Amplitude Accuracy:** 0.5%

Output Channel Specifications

- Output Channels:** one channel per module
- Connector Type:** BNC
- D/A Resolution:** 24 bits
- Sampling Rate:** up to 100 kHz
- Dynamic Range:** 90 dB
- Output Impedance:** 50 Ω
- Maximum Output Current:** 250 mA
- Digital Filter:** high-pass and low-pass digital filters
- Output Range:** programmable 0 to ± 5 Volts Maximum 5 V_{pp}
- Output DC Accuracy:** 1% of full range after calibration

Isolated Digital Input and Output

- Connector:** 25-pin female D-SUB
- External Circuit Power Supply:** 3.3 to 12 V_{DC} ($\pm 10\%$)
- Internal Power:** 3.3 V_{DC} 350 mA, 12 V_{DC} 400 mA
- Maximum Allowable Distance of Signal Extension:** 50 meters

DIO Inputs

- Input Format:** opto-isolated input (compatible with current-sink output)
- DIO Input Channels:** 8 (all available for interrupts)
- Input Resistance:** 6.1 k Ω

Input On Current: 2.0 mA or more

Input Off Current: 0.16 mA or less

Interrupt: 8 input signals are arranged into a single interrupt output signal. An interrupt is generated either at the rising edge (HIGH-to-LOW transition) or falling edge (LOW-to-HIGH transition).

DIO Outputs

Output Format: opto-isolated input (current sink output)

DIO Output Channels: 8 channels

Output Rating: output voltage 12 V_{DC} max, output current 100 mA per channel max

Residual Voltage with Output On: 1 V or less (Output current < 100 mA)

RS-485

Purpose: connection of handheld control pendant and other customized interface devices

Connector Type: 9-pin female D-SUB

Pin Assignment: RS485 receiver, RS485 driver, +5 V power, abort line, GND

System Specifications

On-Board Memory: 4 GB non-volatile flash memory, 32 MB DRAM

Power Management: active and sleep mode

Ethernet: 100Base-T, RJ45 female connector supports connection to PC or network switch

Internal Clock: maintains date and time

System Disaster Recovery: dedicated reset pin. Watch-dog based recovery can be enabled.

Cooling: no cooling fan required

Network Protocols and IEEE 1588 Time Synchronization

Multiple Spider modules are synchronized through IEEE 1588 protocol. The synchronization accuracy is better than ± 100 ns with a certified network switch. The data acquired by all the measurement channels will be synchronized. The phase match between channels across different Spider modules is within 1.0 degree at 20 kHz.

IPv4 Protocol Stack: ICMP, IP, UDP, TCP, IGMP

IPv4 Configuration: manual or via DHCP

IEEE 1588v2 Protocol: PTP Ordinary clock, with both E2E and P2P synchronization supported and hardware level timestamp for PTP event messages

Power Specifications

External DC Power: accepts 10 – 24 V ($\pm 10\%$); automobile cigarette lighter capable

AC Adapter: accepts 100 – 240 V_{AC} (47 – 440 Hz),

Power Consumption: less than 25 watts in maximum active mode

Environmental and General Specifications

Enclosure: metal box compliant with CE electrical safety and EMI shielding standards

Spider-DAQ Dimension: 440 x 50 x 188 mm (W x H x D)

Weight: TBD

Electromagnetic compatibility and sensitivity: EN 61326:1997+A1:1998+A2:2001, EN61000-3-2: 2000, EN61000-3-3: 1995+A1:2001

Operating temperature: -10 to +55 °C

Storage temperature -20 to +70 °C

Shock: 50 g's, 315 in/sec, tested at 6 sides, non-operational test

Vibration: 5 - 500 Hz, 0.3 g, tested at 3 sides, operational test

Vibration: 5 - 500 Hz, 2.42 g, tested at 3 sides, non-operational test

Available Modules

8B30

Voltage Input Modules, Narrow Bandwidth

Part Number	Input Range
8B30-01	-10 to +10 mV
8B30-02	-50 to +50 mV
8B30-03	-100 to +100 mV

Common Attributes	Characteristics
Output Range:	-5 to +5 V
Bandwidth:	3 Hz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	±0.05% Span
Supply Voltage:	+5 V _{DC} ±5%
Input Voltage Withstand:	240 V _{AC}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	70 dB
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

8B31

Voltage Input Modules, Narrow Bandwidth

Part Number	Input Range	Output Range
8B31-01	-1 to +1 V	-5 to +5 V
8B31-02	-5 to +5 V	-5 to +5 V
8B31-03	-10 to +10 V	-5 to +5 V
8B31-04	-1 to +1 V	0 to +5 V
8B31-05	-5 to +5 V	0 to +5 V
8B31-06	-10 to +10 V	0 to +5 V
8B31-07	-20 to +20 V	-5 to +5 V
8B31-08	-20 to +20 V	0 to +5 V
8B31-09	-40 to +40 V	-5 to +5 V
8B31-10	-40 to +40 V	0 to +5 V
8B31-12	-60 to +60 V	-5 to +5 V
8B31-13	-60 to +60 V	0 to +5 V

Common Attributes	Characteristics
Output Range:	---
Bandwidth:	3 Hz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	±0.05% Span
Supply Voltage:	+5 V _{DC} ±5%
Input Voltage Withstand:	240 V _{AC}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	70 dB
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

8B32

Current Input Modules

Common Attributes	Characteristics
Output Range:	0 to +5 V
Bandwidth:	3 Hz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	±0.05% Span
Supply Voltage:	+5 V _{DC} ±5%
Input Voltage Withstand:	30 V _{AC}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	70 dB
External I-to-V Resistor:	Internal
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

Part Number	Input Range
8B32-01	4 to 20 mA
8B32-02	0 to 20 mA

8B33

Isolated True RMS Input Modules

Common Attributes	Characteristics
Output Range:	0 to +5 V
Bandwidth:	3 Hz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer 3-way
Accuracy:	±0.25% Span
Supply Voltage:	+5 V _{DC} ±5%
Input Voltage Withstand:	---
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	70 dB
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

Part Number	Input Range
8B33-01	0 to +100 mV
8B33-02	0 to +1 V
8B33-03	0 to +10 V
8B33-04	0 to +150 V
8B33-05	0 to +300 V
8B33-06	0 to 1 A

8B34

Linearized 2- or 3-Wire RTD Input Modules

Part Number	Input Range	Accuracy
8B34-01	-100 to 100	±0.20 °C
8B34-02	0 to 100	±0.15 °C
8B34-03	0 to 200	±0.20 °C
8B34-04	0 to 600	±0.45 °C

Common Attributes	Characteristics
Input Configuration	2 & 3 Wire
RTD Type	100 Ohm Platinum
Output Range:	0 to +5
Bandwidth:	3 Hz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	---
Supply Voltage:	+5 V _{DC} ±5%
Input Voltage Withstand:	30 V _{AC}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	70 dB
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

8B35

Linearized 4-Wire RTD Input Modules

Part Number	Input Range	Accuracy
8B35-01	-100 to 100	±0.20 °C
8B35-02	0 to 100	±0.15 °C
8B35-03	0 to 200	±0.20 °C
8B35-04	0 to 600	±0.45 °C

Common Attributes	Characteristics
Input Configuration	4 Wire
RTD Type	100 Ohm Platinum
Output Range:	0 to +5
Bandwidth:	3 Hz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	---
Supply Voltage:	+5 V _{DC} ±5%
Input Voltage Withstand:	30 V _{AC}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	70 dB
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

8B36

Potentiometer Input Modules

Part Number	Input Range
8B36-01	0 to 100 Ω
8B36-02	0 to 500 Ω
8B36-03	0 to 1,000 Ω
8B36-04	0 to 10,000 Ω

Common Attributes	Characteristics
Output Range:	0 to +5 V
Bandwidth:	3 Hz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	$\pm 0.25\%$ Span
Supply Voltage:	+5 V _{DC} $\pm 5\%$
Input Voltage Withstand:	240 V _{AC}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	70 dB
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

8B37

Non-Linearized Thermocouple Input Modules

Part Number	Range	Accuracy
8B37J	-100 to 760	± 0.43 $^{\circ}\text{C}$
8B37K	-100 to 1350	± 0.73 $^{\circ}\text{C}$
8B37R	0 to 1750	± 0.88 $^{\circ}\text{C}$
8B37S	0 to 1750	± 0.88 $^{\circ}\text{C}$
8B37T	-100 to 400	± 0.25 $^{\circ}\text{C}$

Common Attributes	Characteristics
Output Range:	0 to +5 V
Bandwidth:	3 Hz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	$\pm 0.05\%$
Supply Voltage:	+5 V _{DC} $\pm 5\%$
Input Voltage Withstand:	240 V _{AC}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	70 dB
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

8B38

Strain Gage Input Modules, Wide and Narrow Bandwidth

Part Number	Excitation Voltage	Sensitivity	Input Range	BW	Common Attributes	Characteristics
					8B38-01	3.333 V
8B38-02	10.0 V	3 mV/V	-30 to 30 mV	8 kHz	Output Range:	0 to +5
8B38-03	10.0 V	2 mV/V	-20 to 20 mV	8 kHz	Bandwidth:	3 Hz
8B38-04	3.333 V	3 mV/V	-10 to 10 mV	3 Hz	Mechanical Format:	Modular plug-in-board
8B38-05	10.0 V	3 mV/V	-30 to 30 mV	3 Hz	Isolation Voltage:	1500 V _{rms}
8B38-06	10.0 V	2 mV/V	-20 to 20 mV	3 Hz	Isolation Type:	Transformer/Optical
					Accuracy:	±0.05% Span
					Supply Voltage:	+5 V _{DC} ±5%
					Input Voltage Withstand:	240 V _{AC}
					Gain/Offset Adjust:	---
					NMR (60 Hz) Rejection:	100 dB above 8 kHz
					External I-to-V Resistor:	---
					Output Control:	---
					Output Resistance:	---
					Dimensions:	1.11 x 1.65 x 0.40 inches
					Interface:	7 pin
					Customization:	yes

8B39

Current Output Modules

Part Number	Input Range	Output Range	Common Attributes	Characteristics
			8B39-01	0 to +5 V
8B39-02	-5 to +5 V	4 to 20 mA	Bandwidth:	100 Hz
8B39-03	0 to +5 V	0 to 20 mA	Mechanical Format:	Modular plug-in-board
8B39-04	-5 to +5 V	0 to 20 mA	Isolation Voltage:	1500 V _{rms}
8B39-09	-5 to +5 V	-20 to +20 mA	Isolation Type:	Transformer/Optical
			Accuracy:	±0.05% Span
			Supply Voltage:	+5 V _{DC} ±5%
			Input Voltage Withstand:	20 V _{DC}
			Gain/Offset Adjust:	---
			NMR (60 Hz) Rejection:	60dB per decade, >100Hz
			External I-to-V Resistor:	---
			Output Control:	---
			Output Resistance:	---
			Dimensions:	1.11 x 1.65 x 0.40 inches
			Interface:	7 pin
			Customization:	yes

8B40/41

Voltage Input Modules, 1kHz Bandwidth

Part Number	Input Range	Output Range
8B40-01	-10 to +10 mV	-5 to +5 V
8B40-02	-50 to +50 mV	-5 to +5 V
8B40-03	-100 to +100	-5 to +5 V
8B41-01	-1 to +1 V	-5 to +5 V
8B41-02	-5 to +5 V	-5 to +5 V
8B41-03	-10 to +10 V	-5 to +5 V
8B41-04	-1 to +1 V	0 to +5 V
8B41-05	-5 to +5 V	0 to +5 V
8B41-06	-10 to +10 V	0 to +5 V
8B41-07	-20 to +20 V	-5 to +5 V
8B41-08	-20 to +20 V	0 to +5 V
8B41-09	-40 to +40 V	-5 to +5 V
8B41-10	-40 to +40 V	0 to +5 V
8B41-12	-60 to +60 V	-5 to +5 V
8B41-13	-60 to +60 V	0 to +5 V

Common Attributes

Characteristics

Output Range:	---
Bandwidth:	1 kHz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	±0.05% Span
Supply Voltage:	+5 V _{DC} ±5%
Input Voltage Withstand:	240 V _{AC}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	100dB per decade, >100Hz
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

8B42

2-Wire Transmitter Interface Modules

Part Number	Input Range	Output Range
8B42-01	4 to 20 mA	0 to +5 V
8B42-02	4 to 20 mA	+1 to +5 V

Common Attributes

Characteristics

Output Range:	---
Bandwidth:	100 Hz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	±0.05% Span
Supply Voltage:	+5 V _{DC} ±5%
Input Voltage Withstand:	40 V _{rms}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	100dB per decade, >100Hz
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

8B45

Frequency Input Modules

Part Number	Input Range
8B45-01	0 to 500 Hz
8B45-02	0 to 1 kHz
8B45-03	0 to 2.5 kHz
8B45-04	0 to 5 kHz
8B45-05	0 to 10 kHz
8B45-06	0 to 25 kHz
8B45-07	0 to 50 kHz
8B45-08	0 to 100 kHz

Common Attributes

Characteristics

Output Range:	0 to +5 V
Zero Crossing Hysteresis:	± 50 mV
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	±0.10% Span
Supply Voltage:	+5 V _{DC} ±5%
Input Voltage Withstand:	240 V _{rms}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	---
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

8B47

Linearized Thermocouple Input Modules

Part Number	Range	Accuracy
8B47J-01	0 to 760 °C	±0.24%
8B47J-02	-100 to 300 °C	±0.24%
8B47J-03	0 to 500 °C	±0.21%
8B47J-12	-100 to 760 °C	±0.24%
8B47K-04	0 to 1000 °C	±0.24%
8B47K-05	0 to 500 °C	±0.24%
8B47K-13	-100 to 1350 °C	±0.24%
8B47K-14	0 to 1200 °C	±0.24%
8B47T-06	-100 to 400 °C	±0.48%
8B47T-07	0 to 200 °C	±0.39%

Common Attributes

Characteristics

Output Range:	0 to +5 V
Bandwidth:	3 Hz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	±0.05%
Supply Voltage:	+5 V _{DC} ±5%
Input Voltage Withstand:	240 V _{AC}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	70 dB
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

8B49

Voltage Output Modules

Part Number	Range	Output Range
8B49-01	0 to +5 V	-5 to +5 V
8B49-02	-5 to +5 V	-5 to +5 V
8B49-03	-5 to +5 V	0 to +5 V
8B49-04	0 to +10 V	-10 to +10 V
8B49-05	-10 to +10 V	-10 to +10 V
8B49-06	-10 to +10 V	0 to +10 V
8B49-07	-5 to +5 V	-10 to +10 V

Common Attributes

Characteristics

Output Range:	---
Bandwidth:	1 kHz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	±0.05% (0-5 mA load)
Supply Voltage:	+5 V _{DC} ±5%
Input Voltage Withstand:	40 V _{rms}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	70 dB
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes

8B50/51

Voltage Output Modules, 20 kHz Bandwidth

Part Number	Range	Output Range
8B50-01	-20 to +20 mV	-5 to +5 V
8B50-02	-50 to +50 mV	-5 to +5 V
8B50-03	-100 to +100	-5 to +5 V
8B51-01	-1 to +1 V	-5 to +5 V
8B51-02	-5 to +5 V	-5 to +5 V
8B51-03	-10 to +10 V	-5 to +5 V
8B51-04	-1 to +1 V	0 to +5 V
8B51-05	-5 to +5 V	0 to +5 V
8B51-06	-10 to +10 V	0 to +5 V
8B51-07	-20 to +20 V	-5 to +5 V
8B51-08	-20 to +20 V	0 to +5 V
8B51-09	-40 to +40 V	-5 to +5 V
8B51-10	-40 to +40 V	0 to +5 V
8B51-12	-60 to +60 V	-5 to +5 V
8B51-13	-60 to +60 V	0 to +5 V

Common Attributes

Characteristics

Output Range:	---
Bandwidth:	20 kHz
Mechanical Format:	Modular plug-in-board
Isolation Voltage:	1500 V _{rms}
Isolation Type:	Transformer/Optical
Accuracy:	±0.05% (0-5 mA load)
Supply Voltage:	+5 V _{DC} ±5%
Input Voltage Withstand:	40 V _{rms}
Gain/Offset Adjust:	---
NMR (60 Hz) Rejection:	70 dB
External I-to-V Resistor:	---
Output Control:	---
Output Resistance:	---
Dimensions:	1.11 x 1.65 x 0.40 inches
Interface:	7 pin
Customization:	yes