



# Spider-H Specifications

Version 1.02, Dated July 15, 2013



## Introduction

### Designed for HALT/HASS

The Spider-H is designed by Crystal Instruments for HALT/HASS applications. The Spider-H modules feature four voltage/IEPE input channels in addition to measurement channels for temperature and humidity. Output channels provide various signal output waveforms to drive an electro-dynamic shaker, hydraulic shaker or pneumatic hammer. Six temperature control outputs and four humidity control outputs create the most powerful HALT/HASS chamber in the world. The Spider-H also features a built-in isolated digital I/O interface. Programmable vibration ramps, gRMS level, and test duration are all synchronized with temperature and humidity control profiles. Typical temperature control is accurate as +/- 0.5 C after stabilization.

### Simple Network Connection

Ethernet connectivity allows the Spider-H to be located far from the host PC. This distributed structure greatly reduces the noise and electrical interference in the system. One PC monitors and controls multiple Spider-H controllers over the network. Since the control processing and data recording are executed locally inside the controller, the network connection does not affect control reliability. With wireless network routers, the PC easily connects to the Spider-H via Wi-Fi.

### Time Synchronization between Multiple Modules

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

### Designed for High Control Performance

By using enhanced control algorithms and a simplified DSP architecture, the feedback loop time for temperature and humidity is greatly reduced. Advanced adaptive PIO algorithms are developed to suit into various temperature profiles. It also provides faster responses for superior safety protection.

### Black Box Mode: Operate without PC

The Spider-H performs in *Black Box mode* which allows it to operate without a computer. In this mode, a PC is only used to configure the control system before the system starts the operation and to download data after the test is complete. During the test, the controller is operated according to a preset schedule or from an external device, such as a Wi-Fi enabled PDA or iPad. Black Box mode is included with every Spider-H module.

### Integrated with Dynamic Signal Analysis

The Spider-H is integrated with general signal analysis functions including time stream recording, transient capture, FFT, auto power spectra, and transfer function analysis. Multiple Spider-H modules work together to form one integrated system. For more details about the development of VCS technology contact Crystal Instruments for the related white paper.

## Hardware Specifications

### Vibration Input Channels

**Input Channels:** 4  
**Connector Type:** isolated BNC  
**Coupling:** AC Voltage, DC Voltage, IEPE (ICP®)  
**IEPE DC offset Voltage and Current:** 21 V at 4.7 mA  
**Input Range:**  $\pm 10 V_{pk}$   
**Input Impedance:** 500 k $\Omega$   
**Input Protection Voltage:**  $\pm 40 V_{pk}$   
**AC Coupling:** analog high-pass filter, -3 dB @ 1 Hz  
**A/D Resolutions:** 24-bit  
**Anti-Aliasing Filter:** analog anti-aliasing low-pass filters in addition to sigma-delta converters  
**Digital Filter:** high-pass and low-pass filters (user programmable)  
**Input Dynamic Range:** 100 dB  
**Sampling Rate:** 0.48 Hz to 102.4 kHz, with 54 stages  
**Maximum Useful Bandwidth:** 46.08 kHz  
**Total THD + Noise:** -90 dBfs (DC to 1 kHz)  
**Amplitude Channel Match:** 0.1 dB  
**Channel Phase Match:** better than  $\pm 1.0$  degree, up to 20 kHz  
**Crosstalk:** less than -100 dB  
**Frequency Accuracy:** 0.00025%  
**Common Mode Range:**  $\pm 10 V_{pk}$   
**Common Mode Rejection:** better than 90 dB  
**Amplitude Accuracy:** 0.5%

### Analog Output Channel

Used to control an electro-dynamic or hydraulic shaker

**Output Channels:** 1  
**Connector Type:** isolated BNC  
**D/A Resolution:** 24 bit  
**Sampling Rate:** up to 102.4 kHz per channel, synchronized with input channels  
**Output Dynamic Range:** 100 dB  
**Maximum Output Current:** 25 mA  
**Sine Amplitude Accuracy:**  $\pm 1\%$  (0.34 dB) at 1 kHz for  $0.1 V_{pk}$  to  $5 V_{pk}$   
**Anti-Imaging Filter:** 160 dB/oct digital and analog filters  
**Digital Filters:** high-pass and low-pass digital filters  
**Output Range:**  $\pm 10$  Volts

### Vibration Output

Used to control an air hammer

**Number of Channels:** 1  
**Connector Type:** Screwed Terminal  
**Output Type:** 4-20mA  
**Accuracy:** 1%

### Isolated Digital Input and Output

**Connector:** 25-pin female D-SUB  
**External Circuit Power Supply:**  $24V_{DC}$  ( $\pm 10\%$ )  
**Internal Power:**  $3.3 V_{DC}$  350 mA

**Maximum Allowable Distance of Signal Extension:** 50 meters

### Inputs

**Input Format:** opto-isolated input (compatible with current-sink output)

**Channels:** 24

**Input Resistance:** 6.1 k $\Omega$

**Input On Current:** 2.0 mA or more

**Input Off Current:** 0.16 mA or less

**Interrupt:** 24 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).

### Outputs

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

**Channels:** 8

**Output Rating:** output voltage 24 V<sub>DC</sub> max, output current 100 mA per channel max

**Residual Voltage with Output On:** 1.0 V or less (Output current < 100 mA)

## Temperature Input Channel

**Number of Channels:** 8

**Connector Type:** Screwed Terminal

**Input Type:** J, J, T type Thermocouple

**Input Range:** -200C -- +400C

**Accuracy:** +/-0.5C

## Temperature Control Channel (Output)

**Number of Channels:** 6 (currently 4 channels for heating while 2 channel for cooling)

**Connector Type:** Screwed Terminal

**Output Type:** 24V/50mA

**Input Range:** -200C -- +400C

**Accuracy:** +/-0.5C

## Humidity Monitor Input Channel

**Number of Channels:** 2

**Connector Type:** Screwed Terminal

**Input Type:** National Instrument Humidity input module

**Input Range:** 4-20mA

**ADC resolution:** 16bit

**Maximum sampling Rate:** 1KHz

**Accuracy:** 1mV offset error, 0.01% gain error

## Humidity Control Channel (Output)

**Number of Channels:** 4

**Connector Type:** Screwed Terminal

**Output Type:** 24VDC/50mA

## High Speed Data Port interfacing to Spider-NAS

**Number of Port:** 1

**Connector Type:** 5-pin LEMO

**Maximum distance of cable:** 2 meters

**Theoretical Physical Data Transfer Speed:** 480 Mbits/second

**Data Transfer Speed:** Higher than 819.2ksample/second. Data saved in 32-bit single precision floating point. (Data from all input channels can be streamed to Spider-NAS)

## System Specifications

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

**Ethernet:** 100Base-T, RJ45 female connector

**Internal Clock:** maintains date and time

**Cooling:** no cooling fan required

## Power Specifications

**Power Supply:** external DC power

**External DC Power:** AC adaptor accepts 100 to 240 V<sub>AC</sub> (47 – 440 Hz), DC power 15 V (±10%)

**Power Consumption:** less than 20 watts

## Environmental and General Specifications

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

**Spider-81 Dimension:** TBD

**Weight:** TBD

**Safety Standards:** electromagnetic compatibility and sensitivity: EN 61326:1997+A1:1998+A2:2001, EN61000-3-2: 2000, EN61000-3-3: 1995+A1:2001

**Operating Temperature:** -10 °C to +55 °C

**Storage Temperature:** -20 °C 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

## PC Requirements

**OS Support:** Microsoft XP SP3, Microsoft Vista, Microsoft Windows 7, Microsoft Windows 8

**OS Type:** 32-Bit and 64-Bit

**Minimum Processor Speed:** 1.5 GHz Dual Core x86

**Minimum RAM Memory:** 2 GB

**Minimum Free Space:** 10 GB

Microsoft Office 2003 or newer must be installed to use the Report Feature. Active X reporting feature requires Office 2007 or newer to be installed.



Figure 1 Typical vibration control in gRMS

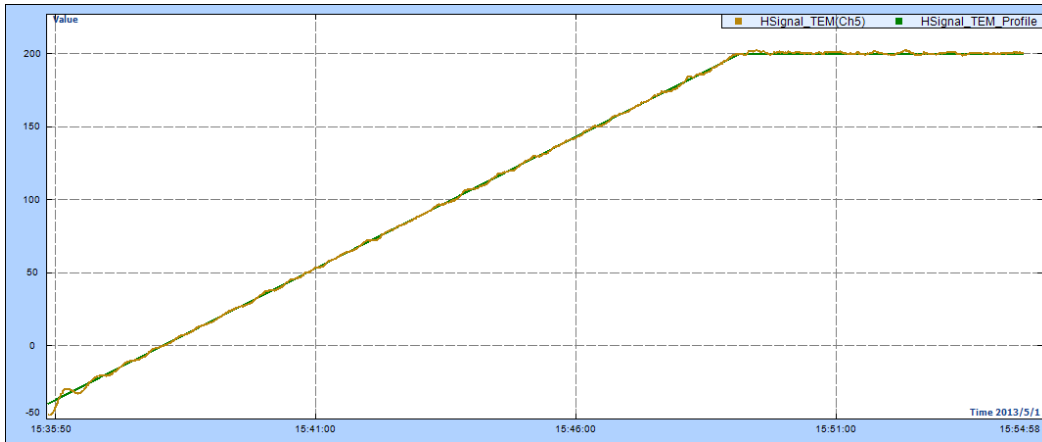


Figure 2 Typical temperature control following the profile

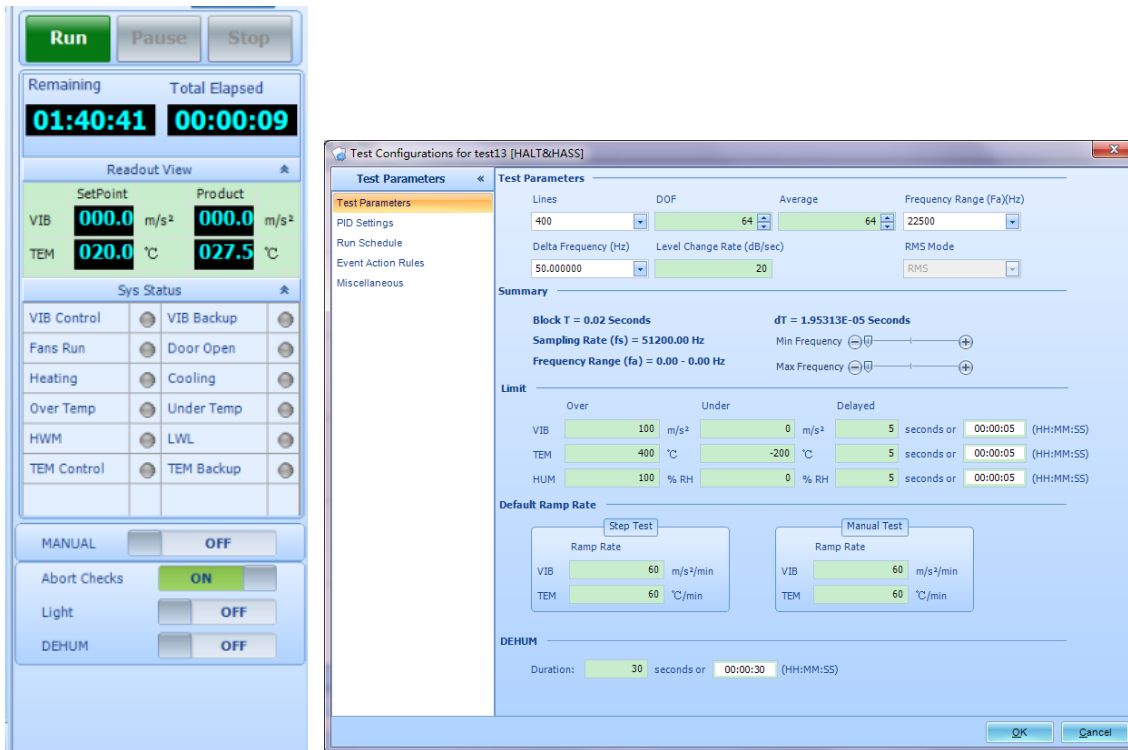


Figure 3 Control Panel and test setup