Bird Diagnostic System

Inline VI Probe Technology

The Bird Diagnostic System (BDS2) is a revolutionary tool for measuring voltage and current in complex applications.

Where repeatability of sensitive RF measurements is important, such as during the processing of silicon wafers, the BDS2 provides never-before seen data. Each system is comprised of a sensor that attaches in-situ in the RF feed line, a receiver that performs the data conversion and communicates to your workstation, and a calibrated data cable that connects the sensor and receiver. With the ability to make measurements post-matchbox, the BDS2 uncovers signal characteristics that are not visible to traditional test equipment pre-matchbox.

Using sophisticated parallel signal processing, the BDS2 is able to simultaneously measure and report voltage, current, and phase angle at multiple fundamental, harmonic and intermodulation frequencies. A robust frequency tracking algorithm is employed to guarantee accurate measurements are made under very dynamic signal conditions. With this data, power and impedance are calculated at each frequency, giving users the ability to identify small discrepancies that may make the difference between a successful and a failed process. This makes the BDS2 an incredible tool for researching new RF technologies and repeating high precision processes. The BDS2 is compatible with existing BDS sensor and cable installations.

The optional Time-Domain mode allows unprecedented visibility into the shape of pulsed RF waveforms in the non 50-Ohm environment. Very similar to an oscilloscope, the BDS2 will display a one-shot, triggered view of the pulse envelope. Very different from an oscilloscope, the BDS2 will display the waveform in voltage, current, phase, power, or impedance to the fully-specified accuracy of the system.

FEATURES

Up to 3 fundamental frequencies can be measured simultaneously with a single BDS2 system. This feature aids in developing repeatable processes, troubleshooting components and identifying process drifts.

High-speed pulse tracking enables the BDS2 to make measurements under simple or complex pulse conditions, providing unprecedented visibility into process performance.

APPLICATION

- Chamber to Chamber Matching.
- Impedance Matching can reveal problems such as poor RF connections, worn electrodes and changes in the process gas mixture.
- Harmonic Levels up to 252 MHz are available for analysis.
- V, I, Phase and Delivered Power Comparison.

PARAMETER SPECIFICATIONS

Frequency Range	307 kHz - 252 MHz (Sensor Dependent)
Frequency Resolution	100 Hz
Frequency Accuracy	± 1 kHz
Number of fundamentals*	Up to 3 simultaneously. For more than 1 fundamental, choose from the following: 0.4, 13.56, 160.0 MHz; 0.4, 60.0 MHz; 1.0, 13.56 MHz; 2.0, 27.12, 60.0 MHz; 3.2, 40.68 MHz; 3.2, 60.0 MHz; 12.88, 40.68 MHz; 13.56, 100.0 MHz
Harmonics	4 harmonics per fundamental, 6 intermodulation products per pair of fundamentals, up to 252 MHz. Limited by maximum number of measurement channels (12 in standard mode, 6 in time domain mode).
Measurements	Voltage, current, phase, frequency, impedance, power at frequencies selected by user
Update Rates	100 Hz typical
Network Protocol (Future Enhancements)	Ethernet (DeviceNet, EtherCAT)
RF Power, Max	Determined by RF sensor, (Typically 10kW or higher)
RF Connector	Custom or QC
Operating Modes	Tracking Mode, Spectral Search Mode

Tracking Characteristics	
Frequency Slew Rate	2 GHz/sec
Minimum Pulse Width	5 µsec

SYSTEM COMPONENTS

Receiver (Unlocked System)

7001A900-2	BDS2 Single Ch. Receiver w/Ethernet

Calibrated Data Cable Options (Unlocked System)

7001B040-5M	RF/Data Cable Set 5M straight

Sensor Options* (Unlocked System)

7001A550-1-XX YY	Sensor, BDS2, QC Connector *Choose XX YY connector options:*

Input (XX) & output (YY) connector options:

01 – QC N(f)	02 – QC N(m)	12 – QC HN(f)
13 – QC HN(m)	14 – QC 7/16(f)	15 – QC 7/16(m)

Other connector options available upon request

7001A550-2	Sensor, BDS2, Protruding Dielectric Connection

Kits (Locked System)

7001A500-1-XX YY	BDS2 Kit, QC Connectors

Input (XX) & output (YY) connector options:

01 – QC N(f)	02 – QC N(m)	12 – QC HN(f)
13 – QC HN(m)	14 – QC 7/16(f)	15 – QC 7/16(m)

Other connector options available upon request

7001A500-1-2	BDS2 Kit, Prodtruding Dielectric Connection

Time Domain Measurement

7001A993-1	Factory Install License
7001A993F-1	Field Install License

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GENERAL SPECIFICATIONS

Receiver Operating	+20 to +40 °C (68 to 104 °F)
Receiver Storage	-20 to +80 °C (-4 to +176 °F)
Cable Operating	0 to +100 °C (32 to 212 °F)
Cable Storage	-20 to +100 °C (-4 to 212 °F)
Sensor Operating/Storage	Refer to Sensor Specification
Humidity, Max	85% Non-condensing
Air Pressure, min	745 mbar (equivalent to 2,500 m / 8,200 ft. max altitude)
Operating Power	15VDC, 2.5A nominal

TIME DOMAIN MODE SPECIFICATIONS:

Time Resolution	500ns
Configurable Time Scale	0.1 to 10 ms
Average	Trace Average
Trigger	Voltage or current waveform Rising or falling edge External triggering Upper/lower thresholds, and holdoff
Pre- and post-trigger buffer	5% to 95%

PARAMETER	VOLTAGE	CURRENT	PHASE ANGLE
Measurement	RF: 1 to 3000V_{rms} (Note 1)	0.1 to 100 A_{rms} (Note 1)	-180° to + 180°
Resolution	IEEE 754 Single Precision Floating Point		
Uncertainty 307 kHz - 1 MHz Unlocked System (Note 2)	for F_o, ± 1.0 V or 2% of reading whichever is greater for F_n, ± 2.0 V or 4% of reading, whichever is greater (95% confidence interval)	for F_o, ± 0.1 A or 2% of reading whichever is greater for F_n, ± 0.2 A or 4% of reading, whichever is greater (95% confidence interval)	Absolute Angle: for F_o, ≥ 10 V, 1A:, ±1° for F_o, < 10 V, 1A:, ±4° for F_n, ≥ 10 V, 1A:, ±2° for F_n, < 10 V, 1A:, ±6° (95% confidence interval)
Uncertainty 1-252 MHz Unlocked System (Note 2)	for F_o, ± 0.2 V or 2% of reading whichever is greater for F_n, ± 0.4 V or 4% of reading, whichever is greater (95% confidence interval)	for F_o, ± 0.02 A or 2% of reading whichever is greater for F_n, ± 0.04 A or 4% of reading, whichever is greater (95% confidence interval)	Absolute Angle: for F_o, ≥ 10 V, 1A:, ±1° for F_o, < 10 V, 1A:, ±4° for F_n, ≥ 10 V, 1A:, ±2° for F_n, < 10 V, 1A:, ±6° (95% confidence interval)
Uncertainty 307 kHz - 1 MHz Locked System (Note 2)	for F_o, ± 0.5 V or 1% of reading whichever is greater for F_n, ± 1.0 V or 2% of reading, whichever is greater (95% confidence interval)	for F_o, ± 0.05 A or 1% of reading whichever is greater for F_n, ± 0.1 A or 2% of reading, whichever is greater (95% confidence interval)	Absolute Angle: for F_o, ≥ 10 V, 1A:, ±1° for F_o, < 10 V, 1A:, ±4° for F_n, ≥ 10 V, 1A:, ±2° for F_n, < 10 V, 1A:, ±6° (95% confidence interval)
Uncertainty 1-252 MHz Locked System (Note 2)	for F_o, ± 0.1 V or 1% of reading whichever is greater for F_n, ± 0.2 V or 2% of reading, whichever is greater (95% confidence interval)	for F_o, ± 0.01 A or 1% of reading whichever is greater for F_n, ± 0.02 A or 2% of reading, whichever is greater (95% confidence interval)	Absolute Angle: for F_o, ≥ 10 V, 1A:, ±1° for F_o, < 10 V, 1A:, ±4° for F_n, ≥ 10 V, 1A:, ±2° for F_n, < 10 V, 1A:, ±6° (95% confidence interval)

*Contact factory for a custom designed sensor and custom frequency combinations.
Note 1: Maximum power is limited by the size of the sensor line section and connectors. See sensor specification document.
Note 2: At customer specified frequencies.