What is Claimed:

1. A method of calibrating a voltage for use with an ultrasonic transducer of a wire bonding machine in a constant voltage mode, the method comprising the steps of:

(1) determining an impedance value associated with operation of the ultrasonic transducer of a wire bonding machine; and

(2) establishing an adjusted voltage level to replace a reference voltage level for use with the ultrasonic transducer in the constant voltage mode based on the determined impedance value, the adjusted voltage level being a voltage setpoint to be applied to the ultrasonic transducer during operation in the constant voltage mode.

2. The method of claim 1 further comprising a step of establishing ~~a reference voltage and~~ a reference impedance value, and establishing a ratio of the impedance value determined in step (1) to the reference impedance value (Z_{actual}/Z_{ref}), whereby the adjusted voltage level is established in step (2) by applying the ratio to the reference voltage level.

3. The method of claim 1 wherein step (1) includes measuring a current signal passing through the ultrasonic transducer such that a maximum current value may be detected, and then determining the impedance value at the maximum current value.

4. The method of claim 1 wherein step (1) includes measuring a phase difference between the current and voltage of a signal passing through the ultrasonic transducer such that when the phase difference is substantially zero the impedance value may be determined at step (1).

5. A method of calibrating a voltage for use with an ultrasonic transducer of a wire bonding machine in a constant voltage mode, the method comprising the steps of:

(1) determining an impedance value associated with operation of the ultrasonic transducer; and

(2) establishing an adjusted voltage level for use with the ultrasonic transducer in the constant voltage mode based on the determined impedance value,

~~The method of claim 1~~ wherein step (1) includes (a) producing a sinusoidal output signal using a controller of the wire bonding machine, where the sinusoidal signal is swept across a frequency range including a resonant frequency of the ultrasonic transducer; (b) amplifying the sinusoidal output signal; (c) sending the amplified sinusoidal output signal to the transducer; (d) measuring, using the controller, a feedback signal of amplified sinusoidal output signal sent to the transducer; (e) determining the resonant frequency of the ultrasonic transducer through step (d); and (f) determining the impedance value at the resonant frequency of the ultrasonic transducer.

6. The method of claim 5 wherein step (e) includes measuring a current value of the feedback signal, and determining the resonant frequency by determining a maximum current value of the feedback signal.

7. The method of claim 5 wherein step (e) includes measuring a phase difference between a current and a voltage of the feedback signal, and determining the resonant frequency when the phase difference is substantially zero.

8. The method of claim 1 wherein step (1) includes (a) determining a resonant frequency of the ultrasonic transducer; and (b) determining the impedance value at the resonant frequency of the ultrasonic transducer.

9. The method of claim 1 further comprising the step of:

(3) further adjusting the adjusted voltage level using a portability factor determined in connection with operation of the ultrasonic transducer.

10. A computer readable carrier including computer program instructions which cause a computer to implement a method of calibrating a voltage for use with an ultrasonic transducer of a wire bonding machine in a constant voltage mode, the method comprising the steps of:

(1) determining an impedance value associated with operation of the ultrasonic transducer of a wire bonding machine; and

(2) establishing an adjusted voltage level to replace a reference voltage level for use with the ultrasonic transducer in the constant voltage mode based on the determined impedance value, the adjusted voltage level being a voltage setpoint to be applied to the ultrasonic transducer during operation in the constant voltage mode.

11. A wire bonding system comprising:

an ultrasonic transducer; and

a controller, the controller being configured to (1) determine an impedance value associated with operation of the ultrasonic transducer, and (2) establish an adjusted voltage level to replace a reference voltage level for use with the ultrasonic transducer in a constant voltage mode based on the determined impedance value, the adjusted voltage level being a voltage setpoint to be applied to the ultrasonic transducer during operation in the constant voltage mode.

12. The wire bonding system of claim 11 wherein the wire bonding system includes ~~a reference voltage value and~~ a reference impedance value stored in memory, and wherein the controller is configured to establish a ratio of the impedance value to the reference impedance value ($Z_{measured}/Z_{reference}$), and wherein the controller is

configured to establish the adjusted voltage level by applying the ratio to the reference voltage level.

13. The wire bonding system of claim 11 wherein the controller is configured to measure a current signal passing through the ultrasonic transducer such that a maximum current value may be detected, and then the controller determines the impedance value at the maximum current value.

14. The wire bonding system of claim 11 wherein during the determination of the impedance value associated with operation of the ultrasonic transducer, the controller is configured to measure a phase difference between a current and a voltage of a signal passing through the ultrasonic transducer such that when the phase difference is substantially zero the impedance value is determined.

15. A wire bonding system comprising:

an ultrasonic transducer; and

a controller, the controller being configured to (1) determine an impedance value associated with operation of the ultrasonic transducer, and (2) establish an adjusted voltage level for use with the ultrasonic transducer in a constant voltage mode based on the determined impedance value,

~~The wire bonding system of claim 11~~ wherein during the determination of the impedance value associated with operation of the ultrasonic transducer, the controller is configured to (a) produce a sinusoidal output signal swept across a frequency range including a resonant frequency of the ultrasonic transducer; (b) amplify the sinusoidal output signal; (c) send the amplified sinusoidal output signal to the transducer; (d) measure a feedback signal of amplified sinusoidal output signal sent to the transducer; (e) determine the resonant frequency of the ultrasonic transducer; and (f) determine the impedance value at the resonant frequency of the ultrasonic transducer.

16. The wire bonding system of claim 15 wherein during step (e), the controller is configured to measure a current value of the feedback signal, and determine the resonant frequency by determining the maximum current value of the feedback signal.

17. The wire bonding system of claim 15 wherein during step (e), the controller is configured to measure a phase difference between the current and voltage of the feedback signal, and to determine the resonant frequency when the phase difference is substantially zero.

18. The wire bonding system of claim 11 wherein during the determination of the impedance value associated with operation of the ultrasonic transducer, the controller is configured (a) determine a resonant frequency of the ultrasonic transducer; and (b) determine the impedance value at the resonant frequency of the ultrasonic transducer.