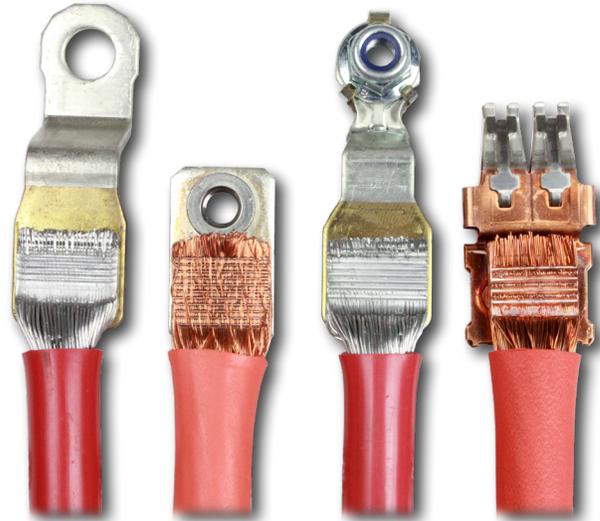
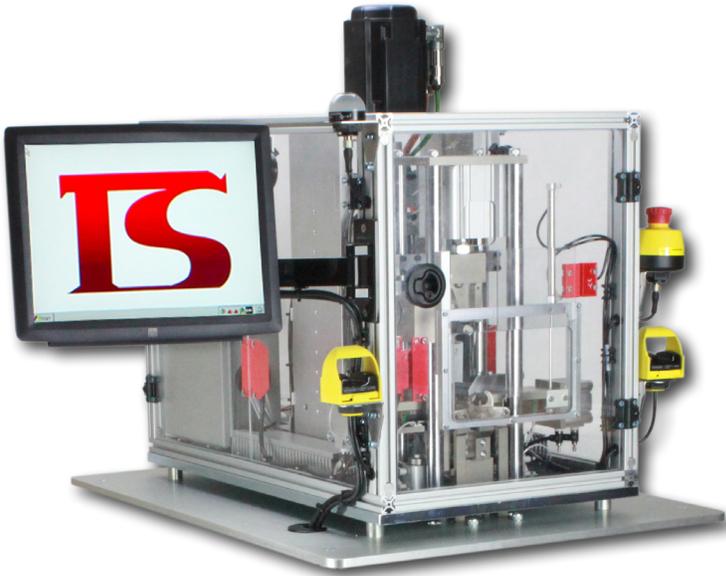


# Digital Servo Cable Terminator

## US-3020STH

U.S. Patent Pending

*The World's First Servo Ultrasonic  
Cable Terminal Welder*



### **Dynamic Force and Amplitude Control™ with Multi-Step Welding**

- Ability to adjust force and amplitude during the weld cycle optimizes parameters for each specific wire application
- Capability of over 20 weld steps with unique force and amplitude while energy and frequency remain constant
- Ideal parameters reduce stress on wires increasing durability
- Welds over 60mm<sup>2</sup> copper and over 95mm<sup>2</sup> aluminum cable at half the power requirement of pneumatic alternatives

### **Industry Leading Missing Volume Detection**

- Capable of detecting missing cable strands
- Retracted wire from weld area detection, or added insulation into the weld area

### **Load Cell Force Feedback**

- Single micron resolution
- Consistent measurement and ultrasonic output produce high cPk values
- Measurement of pre-weld and post-weld height

### **Network Compatible**

- Logs weld height, weld energy, & weld time
- Saves last 20,000 welds; export via USB or TCP/IP

### **Specifications**

<b>Frequency</b>	20 kHz nominal
<b>Ultrasonic Power</b>	3.0 kW max Power Supply 220-240 VAC single phase; 20 Amp max; Nema 6-20r outlet
<b>Pneumatic Pressure</b>	6.5 bars / 94 psi; Air Filter built-in; requires 6mm OD Hose
<b>Weld Force</b>	~5,500 Newton maximum
<b>Weldhead</b>	113 kg / 44.5 x 75 x 77.5 cm 250 lb / 17.5 x 29.5 x 30.5 inches
<b>Controller Cabinet</b>	50 kg / 61 x 61 x 33 cm 111 lb / 24 x 24 x 13 inches
<b>Visual Display</b>	17 inch LCD display and mouse
<b>Additional Options</b>	Wire Cutter Barcode Scanner

### **Welding Capabilities**

<b>Heavy Duty Upgrade</b>	Over 60mm <sup>2</sup> Cu Over 95mm <sup>2</sup> Al
<b>Wire Type</b>	Copper (Cu) Aluminum (Al)

# TECH-SONIC

## ULTRASONIC METAL WELDING

### Proven Automotive Wire Harness Industry Solution

TECH-SONIC has been providing  
Multi-National support for over two decades

**Weld Program Settings**  
Program: (110)

Force [N]	Duration [mSec]	Amp [ $\mu$ m]
1000	300	0.0
600	300	25.0
1200	300	30.0
1100	300	21.0
1200	300	20.0

Weld Mode: Energy

Weld Energy: 6500 J

Buttons: Add, Edit, Delete, Back, Save, Teach, Run

Program 110      Finished: 2 Units Finished  
Step Single weld mode      Welds: 1 Total; 1 Good, 0 Scrap

Active Weld Parameters      tech-sonic      Last Weld Result

Weld Mode	Weld To Energy	Height
Welding	300ms, 1000N, 0.0 $\mu$ m	7.40 6.10
	300ms, 600N, 25.0 $\mu$ m	
	300ms, 1200N, 30.0 $\mu$ m	
	300ms, 1100N, 21.0 $\mu$ m	
	300ms, 1200N, 20.0 $\mu$ m	

Weld Energy 6500 J

Frequency: 20.30 kHz  
Power Loss: 150.00 W  
Energy: 6501.79 J

50.00 mm<sup>2</sup>      Power (3000 W Max)

1384 5793      50.00

Weld Time (2.819 Sec)

Buttons: RUN, TEACH, SETUP, PROGRAMS

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www.techsonicultrasonic.com

US-3020STH Run Screen (Top): This screen displays the machines ability to display pre-weld and post-weld height, weld power, and weld time providing a wide range of quality control. Multi-Step Welding (Left): this teach screen displays the ability to utilize multi-step welding with variable force and amplitude control. The first-step is a compression stage without ultrasonic energy, followed by the changing of parameters over the next three steps, and a final compression stage to measure height.

## TECH-SONIC offers comprehensive multi-national support and service!

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## TECH-SONIC US-3020STH Servo Wire Terminator Video Links

YouTube

[Heavy-Duty Servo Wire Terminator Demo](#)

Vzaar (International Safe Link)

[Heavy-Duty Servo Wire Terminator Demo \(alt\)](#)

## Servo vs. Pneumatic Ultrasonic Wire Terminator Comparison

### TECH-SONIC US-3020STH Digital Servo Wire Termination Machine

- 3.0 kW power supply, 20 kHz frequency
- Max welding 60mm<sup>2</sup> copper wire to terminal
- 5,500 Newton max clamping force
- 220 V power supply

#### Servo Features

- Servo motor with direct drive to control weld head motion
- Dynamic Force and Amplitude Control™ with Multi-Step Welding
  - 20+ possible weld steps
  - Uses optimum welding parameters by changing force and amplitude during weld cycle
- 3% missing volume of CSA detection capability
  - Single missing 0.35mm<sup>2</sup> wire detection
- Fast cycle times as product of pre-weld home position at lower level than full open position
- Cost savings over time in comparison to pneumatic units (see attached Doc. # A10011)
- Increased weld consistency and higher Cpk values with precision control of servo
- Soft touch landing on weld materials creating less stress on wire strands
- Automatic height calibration

#### Pneumatic Features

- Pneumatic cylinders control weld head motion
- Fixed weld force and amplitude and only single step welding
  - Not able to change force and amplitude during welding
- Can not detect single missing 0.35mm<sup>2</sup> wires in common wire bundles
- Weld head must return to full open position each weld cycle extending cycle times
- Inconsistent welding due to inconsistency of air supply, contamination, moisture, etc.
  - Frequent weld failures as a result
- Aggressive landing controlled by pneumatic cylinder
- Pin gauge height calibration, can lead to user errors and faulty calibration

## Advantages of Digital Servo-Controlled Ultrasonic Metal Welders to Traditional Pneumatic Ultrasonic Welders

### Overview

Ultrasonic metal welding is one of many processes used for bonding metals including resistance welding, soldering, and laser welding. Although ultrasonic metal welding can be utilized to join many different materials, it is best suited for the welding of nonferrous metals. Ultrasonic metal welding technology is prominent in key manufacturing sectors such as electric vehicles, lithium batteries, automotive wire harness, solar cells, power electronics, and many others. Weld applications in these industries could benefit considerably from innovative servo-controlled ultrasonic welding technology, which offers much greater precision during welding than the pneumatic driven systems.

TECH-SONIC's innovative servo controlled ultrasonic metal welder, patent pending, is the first and only one of its kind on the market today. TECH-SONIC has pioneered the development of servo controlled ultrasonic metal welders to meet market expectations for critical applications that require extreme precision and quality control. TECH-SONIC's servo-controlled ultrasonic metal welders provide more consistent and repeatable welding than current pneumatic welding systems and boast the ability to set extremely tight quality windows for monitoring important weld parameters such as energy, time, weld height, weld width, and weld force. TECH-SONIC has engineered novel ultrasonic, servo, and load cell feedback processes that provide ultimate digital control throughout the welding process.

Additionally, TECH-SONIC's servo welders include user friendly ergonomic features, advanced graphical user interface, more accurate process control capabilities, and advanced quality control monitoring capabilities compared with pneumatic welders. Due to the enhanced features, servo driven precision control, and innovative feedback processes, TECH-SONIC's new servo ultrasonic metal welders are well positioned to satisfy the growing demand for smarter ultrasonic metal welding technologies.

### Ultrasonic Metal Welding Design and Process

Ultrasonic welding has been widely used in joining plastics for many years and is therefore a well characterized process. Conversely, ultrasonic metal welding has not been as widely adopted and hence, is not as largely understood in the industry. With the growing need for welding nonferrous metals such as copper, aluminum, nickel, and others, ultrasonic metal welding has been recognized for its unique capability by the industry.

Ultrasonic metal welders are compact, easy to incorporate into automation, and economical. They produce high quality welds with short cycle times. Ultrasonic metal welder's hardware consists of an ultrasonic generator, a transducer, a booster, and a welding horn. The process of ultrasonic metal welding depends on controlling the transfer of ultrasonic energy into the weld and two welding parameters that must be controlled to achieve a good result: power (amplitude) and force (pressure).

The power is precisely controlled by the generator and determines the horn's vibration amplitude. The force applied to the weld determines how well the power is transferred into the weld. The generator converts standard line power into a high-frequency, high-voltage sine wave, which is sent to the transducer. The transducer converts the electrical energy into a high frequency compression wave, which is then modified by the booster and passed through the horn into the part(s) to be welded.

The horn has a knurled or waved surface to grip the parts to be welded. In combination with the horn, there is a stationary anvil. The material to be welded is positioned between the horn and anvil while the force presses the horn into the materials. The ultrasonic motion of the horn and the friction coefficient of the material causes a

scrubbing action between the various members to be welded. This friction softens the materials under contact. There is a metallurgical diffusion between the parts being welded and a bond is formed. There is no melting of the materials. The welding occurs in a solid state which allows welding of different nonferrous metals.

### **Advancement of Servo Technology**

In the early 1980s, ultrasonic plastic welding showed a significant effect on the weld strength when optimum welding forces were applied. Research has suggested that dynamic force can produce greater weld strength when properly applied for both plastic and metal welding purposes. Force profiling, or adjusting the weld pressure during the weld cycle, has been shown to maximize weld strength while simultaneously decreasing weld cycle time. The development and implementation of servo-controlled ultrasonic metal welding technology is an important step in precisely controlling all welding parameters and providing superior digital process control, the greatest advantage of servo-controlled ultrasonic metal welders.

Force (pressure) in pneumatic ultrasonic metal welders cannot be controlled with the precision and speed achieved by servo force control, which causes excessive deviation in terms of welding quality. With servo-controlled ultrasonic metal welders, the force (pressure) is measured, monitored, and controlled by using a combination of servo motor and load cell feedback. Multi-step welding, where force is applied before the weld energy is introduced in a compression stage, before automatically moving into the welding stage makes it capable of Dynamic Force Control™. Ultrasonic amplitude (power) can also be varied during the weld process, providing additional energy according to the parameters. Servo control also provides for rapid part placement and withdrawal, resulting in shorter cycle times than conventional pneumatic ultrasonic metal welding can achieve.

### **Advantages of Servo Technology**

While the greatest advantage of servo-controlled ultrasonic metal welding is Dynamic Force Control™ and the ability to precisely control all welding parameters throughout the weld process with multi-step welding, there are several other advantages which cannot be achieved using traditional pneumatic ultrasonic welders.

One such advantage is the increased life cycle of the replaceable tooling parts. Whereas pneumatic ultrasonic welders will often introduce more force and power than needed, thus overworking the tooling, servo-controlled ultrasonic welders only introduce as much force and power that is needed for each weld. This leads to much longer tooling life cycles as the horn and anvil are not transferring more energy than needed. They also boast the ability to weld wider ranges of material sizes, which is crucial in eliminating downtime in a production setting and allows the user to quickly change back and forth between wire sizes.

Being 100% digital, servo-controlled ultrasonic welders also simplify the calibration process by removing pneumatic components. Validating the ultrasonic metal welding process becomes easier and more reliable than ever through the automatic process which requires no manual adjustment. The removal of pneumatic components also saves money that would normally be spent on compressed air.

Additionally, servo-controlled ultrasonic metal welders have a feature with the capability to change the way several industries set their production standards: missing strand and missing leaf detection.

### **Missing Strand/Foil Detection**

TECH-SONIC's servo-controlled ultrasonic metal welders have one micron resolution of linear encoder built into the servo. Due to height measurement compensated by the force measurement, the precise servo control using force feedback provides an improved capability to detect missing wire strands and copper foils. The new US-3020WS2 ultrasonic wire splicer and US-3020SRT ring termination machine can detect single missing wire strands, even on wires with cross sections as small as 0.13mm<sup>2</sup>, and below three percent (3%) of the total weld cross section.

Conversely, pneumatic ultrasonic wire splicers and ring termination machines can only detect missing strands if they are greater than five percent (5%) of the total cross section.

Currently, many automobile manufacturers require wire harness producers to detect missing strands within three percent (3%) of the total cross section. The importance of this lies in the fact that during the stripping of wire insulation, strands will sometimes be cut unintentionally by the stripping machines without the user's awareness. Fewer strands in the wire lowers the conductivity of the wire, which at a certain point can become problematic for automobile manufacturers. The ability to detect below three percent (3%) of the total cross section of wires will give automobile manufacturers increased confidence in their electrical wiring and their overall production process.

Additionally, the new US-3020S servo-controlled spot welder, using the same force feedback, has the capability to detect single missing copper or aluminum foils which are base materials as anode and cathode in lithium battery designs. With individual thicknesses of ten microns, the US-3020S has been tested to detect one missing or one additional foil in a stack of sixty (60). Typical pneumatic welders do not have this missing foil technology, so the introduction of the servo technology can improve confidence in the production process for battery manufacturers.

TECH-SONIC servo-controlled ultrasonic metal welders are programmable to hold thousands of weld recipes. The user can set their desired parameters and if the servo force feedback detects materials outside those parameters in the compression stage of multi-step welding, it will signal the error to the user and stop the operation before the welding process occurs.

## Conclusion

With the integration of servo technology in the ultrasonic metal welding process, TECH-SONIC has proven the ability to achieve significant improvements in many key areas of wire splicing, ring termination and spot welding. Dynamic Force Control™ and multi-step welding not only allow for the digital monitoring and adjustment of all weld parameters during the weld process, but also boast the industry's best three percent (3%) missing strand, wire, and foil detection. Servo technology allows for the welding of a wider range of material sizes than are currently possible with pneumatic ultrasonic welders and helps to reduce costs and production downtime. These factors will help to provide reliable solutions across many industries that surpass the standards currently being met by the previous generation of ultrasonic metal welders.

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TECH-SONIC, Inc. is headquartered in Columbus, Ohio, USA with subsidiaries in China, and sales and service offices in Mexico, Germany, India, Thailand and the Philippines. It has been designing and manufacturing high-tech ultrasonic metal welders since 1996. In recent years, the company has devoted its research and development to servo controlled ultrasonic metal welding – the “Holy Grail” of ultrasonic metal welding. As a pioneer in servo ultrasonic metal welding technology, it integrates the latest electronics, hardware, location and force sensors, and control software in new and unique ways.

TECH-SONIC has been serving global companies in electrical, automotive, EV, battery, wire harness, appliance, HVAC, solar, and military industries throughout the world, and its engineers have many years of experience in custom welding systems. The company specializes in designing its automated systems for the customers who seek high productivity, precision welding, and improved yields. To demonstrate that TECH-SONIC equipment can meet your welding needs and assembly specifications, the company provides free welding sample testing. For more information and to apply for free sample testing, please visit our website [www.tech-sonic.us](http://www.tech-sonic.us). For immediate assistance, call Frank Myers in marketing and sales at +1-614-792-3117 or email [frank.m@techsonicultrasonic.com](mailto:frank.m@techsonicultrasonic.com).