



# ΩMEGA PA 250i

## *Users Guide*

Version 20200521 • Part #1142



**sunstone**<sup>™</sup>

The Micro Welder Experts



**ATTENTION: Read the Safety Guide before operating this welder!**  
**Operator assumes all liability.**



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REVISION	DATE	VERSION NO.	DESCRIPTION OF CHANGES
1	06/2020	20200521	Production release.

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## Chapter 1: Welder Setup & Assembly

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### What is in the Box

#### BOX 1 CONTENTS:

(2) Alligator Grounding Clips	(1) Sunstone PA250i Series Power Supply
(1) Foot Pedal	(1) Shielding Gas Hose
(2) Power Supply Mounting Brackets	(1) Sunstone Touchscreen
(1) Electrode Vial (10x 1.0mm Electrodes and 1 Diamond Sharpening Disk)	

#### BOX 2 CONTENTS

(1) Fiberglass Brush	(1) Sunstone Microscope Arm Assembly
(1) Cross Lock Tweezers	(1) Sunstone Safety Guide
(1) System Cover	(1) Flat Peaked Pier

#### ACCESSORIES BOX (Located in Box 2)

(1) Microscope Arm Mounting Hardware	(1) Pair Microscope Eye Piece Shields
(1) Welder Power Cord	(1) Loop Closing Pliers
(1) Welding Stylus Hand Piece	(1) Set Allen Wrenches
(1) Communications Cable (Display Port Ends)	(1) Shutter Cable (RJ45 ends)

### Microscope Arm Assembly Setup

- Remove the Microscope Arm Assembly from the box and place it on your table.
- There are three available options for mounting the Arm assembly to your table. Select one of the following methods and use the required mounting hardware from the accessories box as outlined.

## MOUNTING OPTIONS

### Mounting Option 1 - Clamp to Table

This option is best for tables with accessible edges and for mounting without drilling holes in the table.

*Note: If your table is thicker than 3-1/2" (9cm), follow the instructions for mounting options 2 or 3 on the next page.*

Hardware required from Box 2:

- (1) Angled Bracket C
- (1) Sunstone Microscope Arm Assembly A
- (1) Clamp Mechanism D
- (5) Flat Head Hex Screws G

- Lay the arm assembly down on the tabletop.
- As shown in Figure 5.1, attach the angled bracket (C) to the bottom of the arm using three (3) of the included flat head hex screws (G) using a 4mm (5/16") Allen wrench (L).
- Attach the clamp mechanism (D) to the angled bracket using two (2) of the included flat head hex screws. See Figure 5.2. For thicker tables, attach the clamp mechanism D to the two lower holes in the angled bracket C.
- Adjust the knob on the clamp mechanism (C) until the gap is sufficient for the thickness of your tabletop.
- Lock the arm into place by turning the knob on the clamp mechanism until the clamp is pressing firmly against the bottom of the table.
- Lift the arm assembly up and slide the arm onto the table as shown in Figure 5.3.
- A plastic cable guide cover (E) can be clipped on over the angled bracket if desired. See Figure 5.4

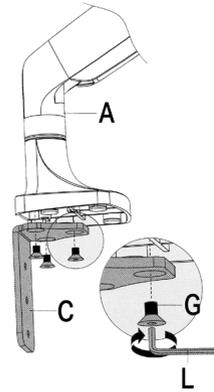


Figure 5.1. Attach angled bracket C to A

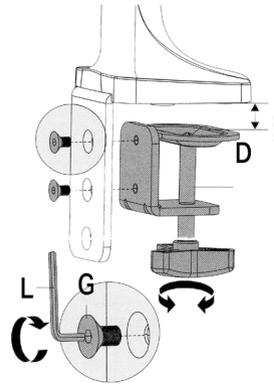


Figure 5.2. Attach clamp mechanism D to angled bracket C.

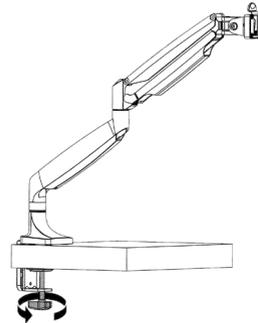


Figure 5.3. Attach clamp mechanism D to angled bracket C.

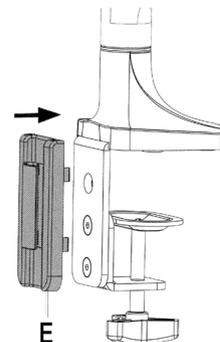


Figure 5.4. Cover the clamp mechanism D with the plastic cable guide cover E.

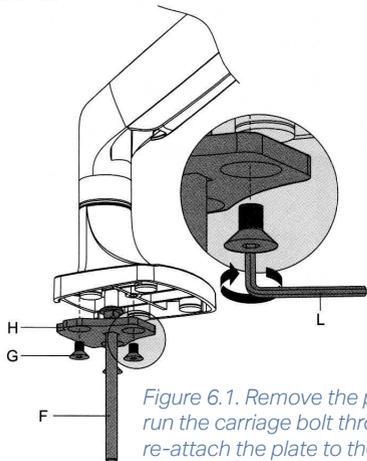


Figure 6.1. Remove the plate from the arm, run the carriage bolt through the plate, then re-attach the plate to the arm.

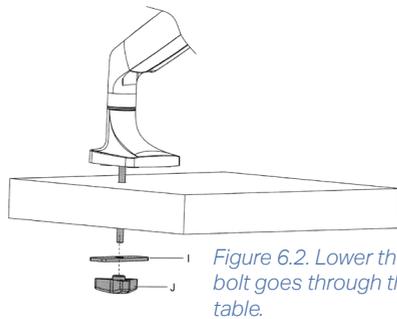


Figure 6.2. Lower the arm so the bolt goes through the hole in the table.

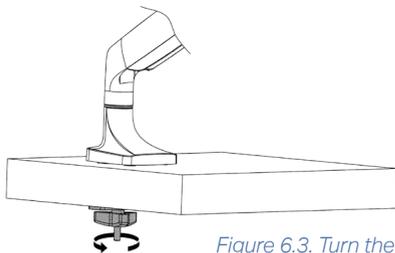


Figure 6.3. Turn the twist knob clockwise to tighten the plate to the table.

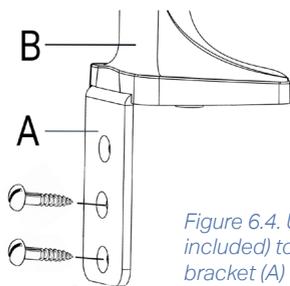


Figure 6.4. Use wood screws (not included) to attach the angled bracket (A) to the table.

## Mounting Option 2 - Bolt through Table

Mounting Option 2 is best for tables without accessible edges. Hardware required from Box 2:

- (1) Flat Mounting Plate H
- (3) Flat Head Hex Screws G
- (1) Long Carriage Bolt F
- (1) Flat Pressure Plate I
- (1) Adjustment Knob J

- As shown in Figure 6.1, using a 4mm (5/32") Allen wrench, unscrew the flat head hex screws (G) holding the mounting plate (H) to the arm.
- Run the included 8mm (5/16") carriage bolt (F) through the included mounting plate (H).
- Attach mounting plate (H) to the bottom of the arm using (3) flat head hex screws (G).
- Drill a 3/8" (9.5mm) hole through the tabletop.
- Lower the arm so the bolt goes through the hole in the tabletop. See Figure 6.2.
- Slide the flat pressure plate (I) onto the bolt. Turn the adjustment knob (J) clockwise to tighten the plate to the underside of the table. See Figure 6.3.

## Mounting Option 3 - Screw to Table (vertical surface)

Required hardware from Box 2:

- (1) Angled Mount Bracket
- (3) Flat Head Screws
- (2) Wood Screws **(not included)**

- Attach the angled bracket (A) to the bottom of the arm assembly using three (3) of the included flat head hex screws (G) as shown in Figure 5.1.
- Lift and position the arm assembly onto the table in the desired location.
- Run wood screws through the bracket (A) and into vertical surface of the table, as shown in Figure 6.4.

## Attach Touchscreen to Microscope Arm Assembly

Once the Microscope Arm Assembly has been firmly secured, the Touchscreen can be attached.

- Remove the Touchscreen from the foam in box 1.
- Line up the mount bracket on the back of the Touchscreen with the slot in the clip mechanism on top of the arm and lower it into the slot until the clip clicks into place. It can be helpful to pull the clip back while sliding down. See Figure 7.1.
- Remove the screen protector film from the front of the Touchscreen.

## Arm Tension Adjustment

The spring tension is factory pre-set, but should changes be desired, the tension can be adjusted by turning a hex screw located on the arm joint, as shown in Figure 7.2. Use the included 6mm Allen wrench to make adjustments.

- Turn the hex screw counterclockwise (in the direction of the "+" symbol on the arm) if the arm does not hold the microscope up.
- Turn the hex screw clockwise (in the direction of the "-" symbol) if the arm does not allow the microscope to be lowered easily.

## Microscope Setup

- Install the rubber eyepiece covers onto the microscope lenses.
- Plug the included Shutter Cable into the RJ45 port on the microscope (the bottom of the microscope head). See Figure 7.3.
- Plug the other end of the Shutter Cable into the shutter port on the back of the Touchscreen.

*Note: Connecting other RJ45 compatible devices to the Sunstone shutter RJ45 port may damage the welder and/or the other devices.*



*Figure 7.1. Attach the Touchscreen to the Microscope Arm Assembly. Remove the screen protector film.*



*Figure 7.2. Adjust the tension of the Arm Assembly for more loose or more tight movement.*



*Figure 7.3 After installing the rubber eyepiece covers, use the Shutter Cable to connect the Touchscreen to the bottom of the microscope head.*



Figure 8.1. Mount the Welding Stylus to the holder below the microscope.



Figure 8.2. Tubing and other cables can be routed up and through the removable cable guide portion of the arm.



Figure 8.3. When looking through the microscope, the stylus should appear in the center of your focus, as shown here.

## Welding Stylus

- Remove the Welding Stylus from the accessories box.
- Insert the Welding Stylus into the holder at the bottom of the arm assembly as shown in Figure 8.1.
- The tubing can be routed up and through the removable cable guide portion of the arm if desired. See Figure 8.2.
- For now, position the Welding Stylus such that only the smaller diameter portion protrudes from the holder. Then, tighten the thumb screw on the bottom of the stylus holder to hold it in place.
- Rotate the stylus holder to approximately a 45-degree angle as shown in Figure 8.1 (the stylus should be angled down).
- Fine tune the position of the Welding Stylus while looking through the microscope: Loosen the thumb screw on the bottom side of the stylus holder and slide the Welding Stylus forward and backward until the tip of the Welding Stylus is in the center of your focus. See the example in Figure 8.3.
- Now securely tighten the Welding Stylus in place by tightening the thumb screw on the bottom of the stylus holder, which you can see in Figure 8.1.

### Stylus Components

Figure 8.4



Stylus Shaft A

Collet B

Collet Cap C

Electrode D

Stylus Hull E

## Electrode Setup

The PA250i comes standard with a 1.0mm electrode collet and ten (10) 1.0mm electrodes. The 1.0mm electrodes are a good multipurpose electrode for most welding applications. Available separately, Sunstone offers 0.5mm electrodes, which are more suited for very small applications (less than 5 Ws of energy).

### INSTALL THE TUNGSTEN ELECTRODE ONTO THE WELDING STYLUS

See the Stylus Components Chart (Figure 8.4) on previous page to install the tungsten electrode (D).

- Remove the stylus hull (E) by pulling it away from the stylus shaft (A). See Figure 9.2.
- Loosen the collet cap (C) by twisting it counter-clockwise.
- The welder accommodates 0.5mm and 1.0mm electrodes. The electrode stylus will be shipped with the 1.0mm electrode collet (B) installed.

- Insert a 1.0mm electrode (D) into the collet. **Helpful Tip: There is an engraved guide on the side of the stylus hull (E) that helps measure the electrode length. Place the end of the stylus hull (E) against the collet cap, then make sure the electrode extends as indicated. See Figure 9.3.**

- There should be between 0.6 - 0.7 inch (1.5 – 2cm) of the electrode (D) protruding from the stylus shaft (A). This will allow the electrode enough room to stick out from the stylus once the stylus hull (E) is placed back on the stylus.
- Lock the electrode (D) into place by hand tightening the collet cap (C) in a clockwise direction.
- Replace the stylus hull (E) by pushing it in until you feel it snap back into place. The electrode (D) should stick out between 1/8 – 1/4 inch (3.175 – 6.35mm after the stylus hull is snapped back into place). See Figure 9.4.

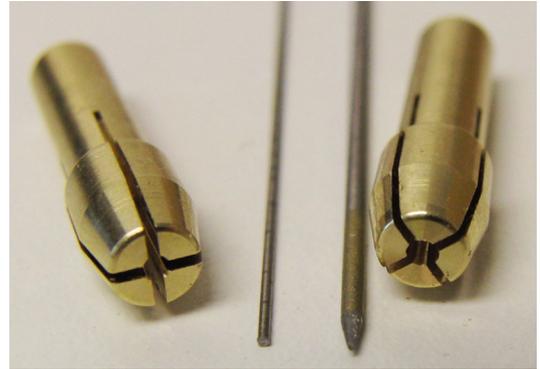


Figure 9.1. The PA250i is shipped with a 1mm collet and ten (10) electrodes. Also available from Sunstone are 0.5mm electrodes and applicable collet.



Figure 9.2. To install the electrode, first remove the stylus shaft from the stylus hull by pulling them apart.



Figure 9.3. Use the guide engraved on the side of the stylus hull E for proper electrode D positioning.



Figure 9.4. The electrode should protrude past the stylus hull 1/8 to 1/4 inch (3.175 to 6.35mm).



Figure 10.1. Turn this knob to adjust microscope focus. You'll find one knob on each side of the microscope arm.



Figure 10.2. Use the two mounting brackets to attach the Power Supply to wall or other vertical surface.



Figure 10.3. Power Supply back panel.

## Adjusting The Microscope Focus

- Twist the knob on the microscope forward and backward to lower and raise the head. This will allow you to focus the microscope on the welding stylus. See Figure 10.1.
- Place your finger under the welding electrode to help judge the correct focus location. Focus the microscope until the texture on the skin of your finger is clearly visible.

## Power Supply Setup

### POWER SUPPLY SUPPORT MOUNT BRACKETS

The PA250i Power Supply can either be mounted to a flat vertical surface (such as a wall or the side of a desk) using mounting brackets, or rest on a flat horizontal surface. Keep in mind that the Power Supply will need to be mounted in proximity to the Microscope Arm Assembly.

### Mounting Brackets

If you wish to mount the Power Supply to a vertical wall, attach the mounting brackets only to a structurally sound vertical support. One mounting bracket should attach to the top of the Power Supply and one to the bottom.

Attach the lower mounting bracket to the wall first (using wood screws or other appropriate hardware, not included) and attach the Power Supply to the lower mounting bracket using the two provided screws. Next, attach the upper mounting bracket to the Power Supply, then attach the upper mounting bracket to the wall. See Figure 10.2.

## Power Supply Setup - Back Panel

All required cables are found in the accessories box.

- Plug the female end of the included power cable into the 90-250 VAC Power Port.
- Connect the male end of the power cable into AC power (wall outlet). The PA250i can accept voltages ranging from 90VAC to 250VAC. (When plugged in for the first time the Power Button LED will blink a couple of times and then turn off.)

- Insert the included 1/4" gas tube firmly into the Shield Gas Port. The tube may feel loose when connected but should not come out if pulled.
- Plug the foot pedal cable into the Foot Pedal Port.
- Insert the stylus connector into the Weld Stylus Port on the back panel of the Power Supply. Ensure that the white circular indicator on the stylus is lined up with the white indicator on the Weld Stylus Port. The connector will snap into place.
- When making welds using the stylus, an alligator clip cable can be connected to the Pulse Arc+ Port on the back of the Power Supply for grounding the workpiece during the weld.
- When tack welding, plug one alligator clip cable into the Tack+ Port and one into the Tack- Port. Be sure to attach each alligator clip to each workpiece before tack welding them together.
- Plug the included communications cable (long display port cable) into the Comm. Port.
- Plug the other end of the communications cable into the Comm. Port on the back of the Touchscreen (the cable can be routed through the removable cable guides on the Microscope Assembly Arm).
- If using the unit with the Omega PAWH weld head (whether manual or CNC head), follow these steps:
  - Connect the red spade connector to the Pulse Arc+ Port, and the black spade connector to the Tack- Port.
  - Plug the standard RJ12 connector to the Acc. Port, with the offset RJ12 connector plugged into the Omega PAWH head.
  - Take the CNC/Sunstone PA250i adapter cable, and plug the green connector into the PLC I/O Port on the PA250i, and the 25 pin parallel connector to the I/O-1 Port (for Janome robotic systems) on the back of the CNC. If you're using a robotic system from a different manufacturer, call Sunstone for assistance.
  - For more information on setting up the Omega PAWH weld head, go to page 15.

*Note: Connecting other display port compatible devices to the PA250i's Comm. Port may damage the welder and/or the other devices.*

## Power Supply Setup - Front Panel

- Push the Power Button to initiate the power up sequence. The Power Button will illuminate. The Touchscreen and the microscope light will begin to power on.

## Electrode Care

### WORKPIECE ELECTRODE PRESSURE

Touch the workpiece to the electrode with very light pressure. Too much pressure will cause the workpiece to stick to the electrode and cause the electrode to become contaminated (workpiece material on the electrode). Sunstone recommends cleaning or changing the electrode when it sticks to the workpiece.



Figure 12.1. A sharp electrode tip improves arc initiation and results in a better overall weld.

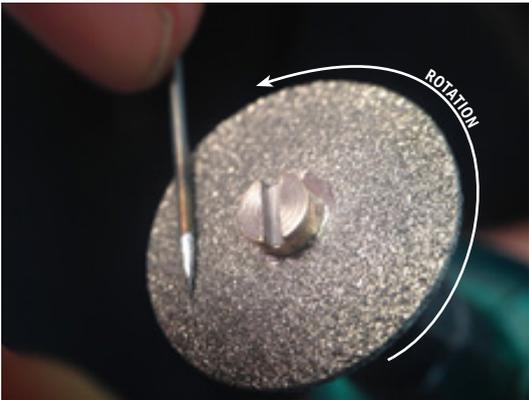


Figure 12.2. Use a rotary tool to sharpen the electrode.

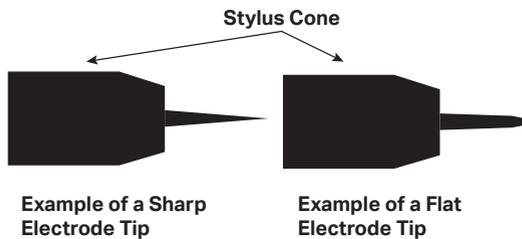


Figure 12.3.

## When to Sharpen the Electrode

Refer to Chapter 3 for more information on electrodes.

The majority of applications are best accomplished using a sharp electrode tip. A sharp tip improves arc initiation and helps focus the arc properly. It is recommended that you pay close attention to the electrode condition. An electrode that appears to be dark colored or covered with material from previous welds can lead to inconsistent welding and poor ignition of the weld arc. When this occurs, simply sharpen the electrode with the included diamond disk. The diamond disk can be attached to a rotary tool. Follow these steps for sharpening the electrode:

- Completely remove the electrode from the stylus.
- Pinch the electrode between the thumb and index and/or middle finger with the shaft going perpendicular to the fingers. See Figure 12.1.
- Power on the rotary tool then hold it with the opposite hand.
- Place the electrode tip on the diamond disc so the grit of the disk is moving parallel with the electrode shaft and moving towards the tip. See Figure 12.2. Sharpening the electrode in a way other than explained here will affect the quality of the weld.
- Set the electrode on the diamond disk at a 10-degree angle and begin to spin the electrode with the thumb and middle finger. **Tip: A helpful way to get a sharp electrode is to push down on the electrode with your index finger while twisting the electrode with the thumb and middle finger. See Figure 12.2**
- Once the electrode is sharp and clean, turn off the rotary tool and insert the electrode back into the stylus as explained above.

*Note: As a rule of thumb, Sunstone recommends a sharpened electrode anytime a new workpiece is being welded.*

## WHEN TO FLATTEN/ BLUNT THE ELECTRODE

- When working with silver, copper, and other highly conductive metals in energy levels above 20 Ws,

it is recommended to blunt the electrode instead of sharpening it, as shown in Figure 12.3. A flat or blunted electrode is ideal when using the Omega PAWH weld head.

- Follow the “When to Sharpen the Electrode” instructions on the previous page.
- Once the electrode is sharp and clean, turn the electrode to a 90-degree angle and push it against the diamond disk in order to place a flat/blunt tip on the electrode. Cleaning the edge of a blunt tip electrode assists in preventing the electrode from sticking to the weld surface, especially when using the PAWH weld head.
- Once the electrode has a flat/blunt tip, turn off the rotary tool and insert the electrode back into the stylus as explained earlier.

## Shield Gas Setup

During the pulse-arc welding process high temperature plasma quickly melts metal into a molten pool. As the weld is performed, a small amount of shielding gas is released through the weld stylus to prevent oxygen from entering the molten pool. After the weld has occurred the protective gas turns off.

If oxygen from the air enters this molten pool, the result is a metal oxide that is brittle, porous, and burnt-looking. Protective shielding gas is used, such as 99.996% pure argon (Argon 4.6), to prevent these effects.



### PRESSURIZED GAS SAFETY

There are several important rules that should be followed when using a compressed shielding gas such as argon:

**Always secure the pressurized gas tank to a fixed location** (such as a sturdy table leg). If the pressurized gas cylinder were to tip and become damaged there is possibility that the tank could become a projectile, expelling the high-pressure shielding gas as propellant.

**Always turn off the shielding gas at the main valve when finished.** This will help your shielding gas supply last longer in case there is a small leak in the tubing. This is also a good safety practice. If the tube becomes dislodged shielding gas could fill the room and displace oxygen, which can lead to suffocation. Argon is heavier than air and will fill the room from the bottom upward. If you experience a large shielding gas leak, open all of the doors and windows in the room.

### SHIELDING GAS TANK AND REGULATOR SETUP

- Ensure that your shielding gas tank is securely fastened to a stationary point near the welding area.
- Turn the regulator dial COUNTERCLOCKWISE (closed) until it is fully backed out, meaning the dial becomes loose, to prevent over-pressurization of the line.
- Screw the gas regulator onto the shielding gas tank and tighten fully using a wrench.
- If not already done, insert one end of the included ¼” OD gas tubing into the gas port on the back of the power supply. Tug gently on the tube to verify a tight fit.
- Connect the other end of the gas tubing to the gas regulator.
- Open the gas tank at the main valve slowly. The dials attached to the regulator should respond as the

valve is opened. The right dial should measure and show pressure inside the tank; the dial on the left, which measures pressure in the hose, should remain at zero (when the regulator dial is fully backed out).

- Slowly turn the regulator dial CLOCKWISE until the dial on the left shows gas pressure between 7-10 liters per minute.

## Microscope LCD Filter Shutter System

The Microscope LCD Filter Shutter System provides an unobstructed working view before welding and completely protects your eyes during the welding process. The PA250i's internal computer verifies the Microscope LCD Filter Shutter System has been closed before allowing the weld to take place. Should the shutter not close, the microscope lens is equipped with >UV 16 and >IR 16 for maximum eye protection.

## BECOME FAMILIAR WITH THE MICROSCOPE

The Sunstone microscope has been designed to provide maximum visual clarity, eye protection, and ease of use. One challenge using the microscope is getting used to bringing the workpiece to the welding electrode while looking through the microscope. This is an easy challenge to overcome. To begin, follow the suggested practices below while the welder is in Weld Off Mode. While the welder is in Weld Off Mode, it will not be able to make a weld when the workpiece touches the electrode.

- Rest your hands on the table and position the workpiece close to the welding electrode before looking into the microscope.
- Make sure your focus is at the tip of the electrode.
- Use slow, controlled movements.



Figure 14.1. Rest your hands on the table and position the workpiece close to, but not touching the electrode, then look through the microscope.

- It is helpful to have your hands resting on the table and to only use your fingers to move the workpiece up to the electrode. See Figure 14.1.
- Place the workpiece surface perpendicular to the point of the electrode. **As discussed in later chapters, the angle of the electrode tip relative to the workpiece surface is very important and will take practice.**
- Now practice making soft contact with the workpiece to the electrode.
- Once you feel comfortable, attach the alligator clip to the workpiece and enable welds (switching the unit to Weld On Mode) to begin welding. **Be mindful of your energy setting: Too much power may damage the workpiece.**

## Omega PAWH Weld Head Setup

*These instructions are for the manual version of the Omega PAWH Weld Head.*

### CONNECT THE COMPRESSED AIR

- Plug the tube from the compressed air tank into the Air Valve System (A) on the back of the weld head.
- Two air valve ports are located on the back of the weld head and two ports at the top of the weld head. The left port (B1) on the back of the weld head connects to the top port (B2) at the top of the weld head. The right port (C1) on the back of the weld head connects to the bottom port (C2) at the top of the weld head. See Figures 15.1 and 15.2

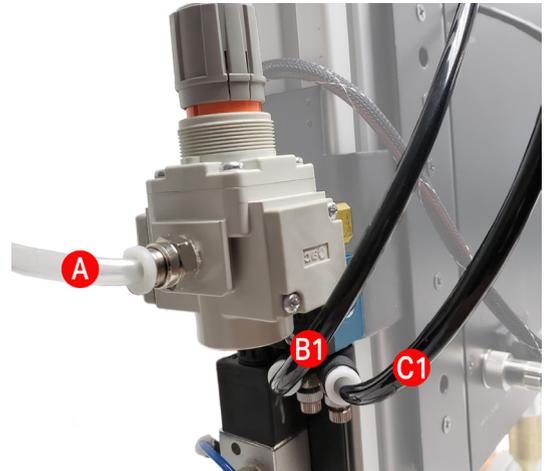


Figure 15.1.

### CONNECT SHIELD GAS

- Using the provided splitter, plug the tubes into the gas port on the back of the Power Supply and into the port on the back of the weld head at the bottom of the Air Valve System (D). See Figure 15.3.



Figure 15.2.

### COMPLETE CABLE CONNECTIONS

- Plug the 4 DIN connector on the back of the weld head into the Valve Control Port on the side of the weld head.
- Using the wires on the weld head, connect the red wire to the Pulse Arc+ Port and the black wire to the Tack- Port on the back of the PA250i.
- Connect the RJ-11 cable to the To Welder Port on the welder and then to Acc. Port on the back of the weld head.
- Plug the AC power cable into the side of the weld head. Then plug the other end into any standard 110-220VAC outlet.

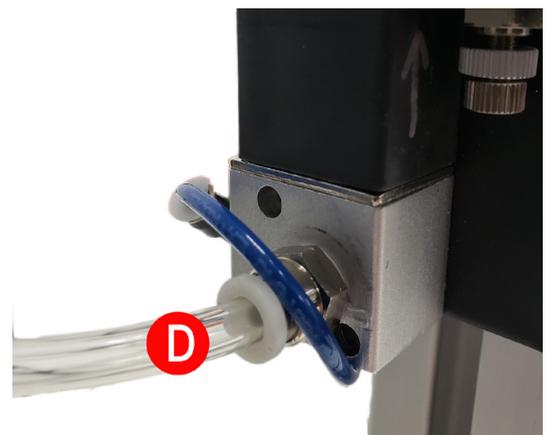


Figure 15.3.

### MOUNT THE WELD HEAD (OPTIONAL)

- To mount the weld head to a table top or bench top, pull the base plate cap off the front of the weld head base. Drill four holes into your table top. Slide the screws into the base, then lower the weld head



Figure 16.1.



Figure 16.2.



Figure 16.3.



Figure 16.4.

into the screw holes, ensuring the weld head will be secured during welding.

## INSTALL THE WELD HEAD BASE PLATE

- Remove the base plate cap.
- Now slide the base plate onto the base of the weld head and tighten the wheel on the side of the base plate to secure.
- Replace the base plate cap. See Figure 16.1.

## INSTALL ELECTRODE IN THE NOSE CONE

- Remove the nose cone from the weld head, as shown in Figure 16.2.
- Twist the electrode holder counterclockwise to open the collet.
- Insert the electrode into the collet. See Figure 16.3.
- Tighten the electrode holder clockwise to secure the electrode in place. The electrode should protrude about ½ to 1 inch out of the holder. See Figure 16.4.
- Replace the nose cone.

*Note: You can choose to use a 1mm or 0.5mm electrode with the Omega PAWH weld head.*

## POWER THE WELDER AND THE WELD HEAD

- Turn on the PA250i using the button on the front of the welder, then turn on the PAWH weld head with the switch found on the side.

## Chapter 2: User Interface Overview

The PA250i interface consists of five main “screens” that can be accessed at any time using the icons located along the top of the screen in the header area:

- Home
- Communications
- Media
- Save/Load
- Settings

### Home Screen

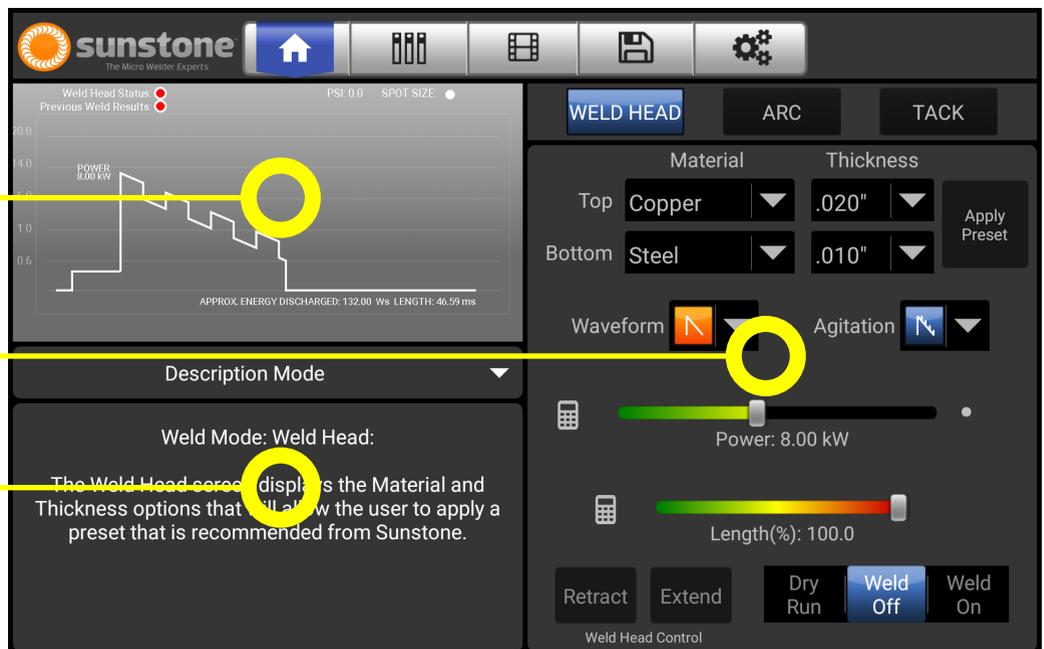
The Home Screen is comprised of three separate areas: The Waveform Graphic Area, The Parameter Selection Area, and the Mini-Screen Area. See Figure 17.1.

Figure 17.1. The Home Screen is organized into three main areas:

Waveform Graphic Area

Parameter Selection Area

Mini-Screen Area



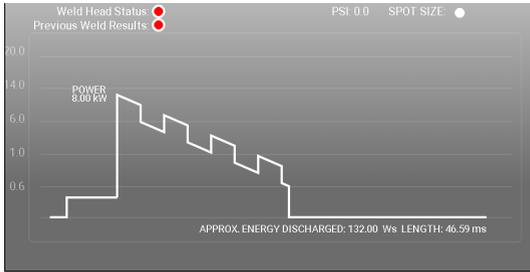


Figure 18.1. The Waveform Graphic Area displays a graphical representation of the active weld. With a gray background, the welder is in safety mode and will not release energy. With a colored background the welder is ready to release energy.

## Waveform Graphic Area

The Waveform Graphic Area (see Figure 18.1) illustrates how energy is released during a weld and provides a quick reference for various settings. The waveform displayed will change based on the control settings you select. (Also see Reading the Waveform Graph on page 43). With a gray background, the welder is in safety mode and will not release energy. With a colored background the welder is ready to release energy.

- Along the left side of the graph, the vertical axis represents the total weld energy available. The horizontal axis represents time (ms). The actual values are displayed below the graph.
- In the upper right-hand corner, an approximation of the weld spot size is shown based on the current settings and represents a full discharge of the total weld energy available, providing a visual reference of changes in spot size as settings are adjusted.
- Current settings are displayed along the bottom of the graph. Energy discharged and weld length values are shown.
- As length decreases, the amount of energy discharged will decrease as represented in text just below the graph. The represented spot size displayed will not decrease, but the actual weld spot size will decrease as length is adjusted down.

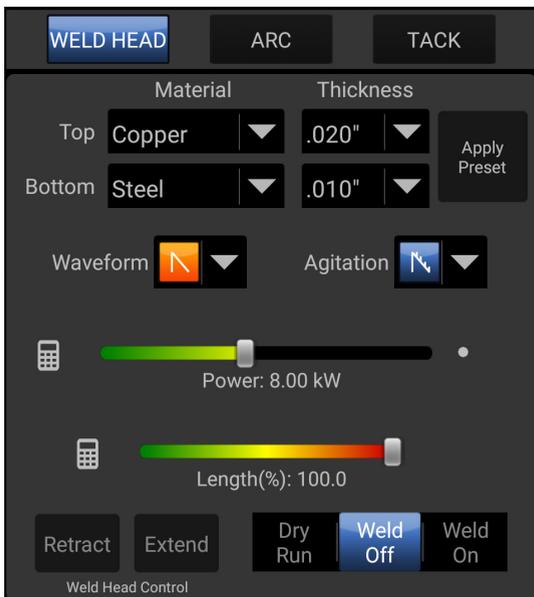


Figure 18.2. The Parameters Selection Area displays the necessary input to control parameters that will affect the weld.

## Parameter Selection Area

The Parameter Selection Area (see Figure 18.2) displays the buttons and sliders used to control parameters that will affect the weld.

### HEADER BUTTONS

The three buttons at the top of the Parameter Selection Area display different controls. Pressing any will change the controls that are displayed in the area.

### WELD HEAD CONTROL LAYOUT

The Weld Head Control Layout lets you select the type of metals being welded and the thickness of the two metals,

and then to apply the Sunstone recommended settings. The PA250i will then adjust settings automatically for that application. Settings can be changed if needed.

*Note: The top material refers to the material that comes into contact with the electrode. For battery welds, as an example, the top material is the tab connecting battery cells, and the bottom material is the battery cell (or can).*

## Select Materials

Under Material, touch the down arrow buttons to select the metal materials from a drop down list. Both top and bottom materials will need to be selected before the Preset Settings can be applied.

## Select Metal Thicknesses

Under Thickness, touch the down arrow buttons to select the thickness of the two metals using the drop down menus. Different materials will have different thicknesses available; select the material before selecting the thicknesses. Both top and bottom metal thicknesses must be selected before Preset Settings can be applied.

## Apply Preset/Preset Loaded

Once materials and thicknesses are selected, press the Apply Preset Button to load Sunstone's recommended settings. **After the preset is loaded the button text will turn orange and display Preset Loaded.** The button will remain in this state until settings are changed, at which point it will revert to the gray Apply Preset text.

## Waveform Drop-down

Use the Waveform drop down menu to select which waveform shape you would like to use for welding. For more information on the strengths of each waveform, see the Waveforms section on page 21.

## Agitation Drop-down

Use the Agitation drop down menu to select which agitation option you would like to use for welding. Please note that in classic mode, Sustained Agitation is disabled above 132 Ws, and Sloped Agitation is disabled above 231 Ws. For more information on the benefits of agitation, please see the Agitation section on page 22.

## Power/Energy Slider

This slider adjusts the amount of energy that is being applied in the weld to achieve desired results for your application. If you need more precision, press the Keypad Icon to open the keypad mode. More information regarding this slider can be found in the Power/ Energy Slider section on page 22.

## Length Slider

Use the Length Slider to adjust the length of the weld discharge. See page 23 to learn more about lengths.

## Weld Head Control

The Retract and Extend Buttons are used to check that there is an appropriate length of electrode extending beyond the collet. Once the electrode is in the collet, extending between ½" and 1" beyond the collet, put the

nose cone on and press the Extend Button. Keep your fingers away from the nose cone until the electrode is done extending, then look at the bottom of the nose cone. The electrode should extend beyond the bottom of the nose cone, and if it doesn't, the electrode will need to be adjusted so it extends further from the collet.

Once you are satisfied with the electrode length, press the Retract Button to return the electrode to its home position within the nose cone.

## Weld State

The Sunstone PA250i has three different Weld States: Dry Run, Weld Off, and Weld On.

- **Weld Off State:** In this state, the welder is not ready to make a weld. There is no energy waiting to be released. In this state, if a weld is triggered a message will appear asking the operator to check the weld state. This state is useful for initial and daily settings setup and electrode maintenance, as there is no worry for accidental welds or weld head movement.
- **Dry Run State:** In Dry Run, the welder accepts weld triggers, and will go through the full weld process (complete with weld head movement), but disables the energy discharge. This is especially useful for testing any timing settings, as well as locations programmed if using a CNC table.
- **Weld On State:** In this state, the welder is fully operational. The energy banks charge to the set energy, and all weld head movement, as well as energy discharge, are enabled. Use this state once you are satisfied with your setup.

## ARC CONTROL LAYOUT

The Arc Control Layout (see Figure 20.1) consists of controls for Waveform, Ignition, Agitation, Energy, Length, and Weld Speed. This allows for adjustments that will allow welding many different types of metals/applications.



Figure 20.1. When you touch "ARC", the button will turn blue and new parameter controls will appear for Waveform, Ignition, Agitation, Energy, Length, and Weld Speed.

## Waveforms

The waveform selections determine and control how energy is released when welds are made.



- **Classic:** The Classic waveform is the default waveform for welding on all Sunstone welders. It has a high initial peak current, followed by a capacitive discharge slope. One key advantage of the Classic waveform is its ability to create large weld spots with shallow surface penetration, which helps keep the overall workpiece cooler. The capacitive discharge slope allows the weld spots to cool with less internal stress, and without surface ripples. Classic welds will typically have a smoother surface than other waveforms.



- **Triangle:** The Triangle waveform is similar to the classic waveform's ability to make smooth and uniform weld results. One key advantage of the Triangle waveform is the ability to set the peak current lower and still be able to discharge the full amount of energy over a longer period of time. Triangle welds will typically get deeper into the weld surface than with Classic. Triangle also provides more control over the total energy being discharged than is possible with Classic.



- **Square:** Similar to the Triangle waveform, a Square waveform allows you to utilize the full amount of energy over a longer period of time. The difference of this waveform compared to Classic and Triangle is the abruptness of power at the start and end of each weld. The Square waveform closely mimics the weld output of a typical laser welder.

## Ignition

The Ignition options control the timing of released energy in relation to the position of the electrode.



- **Standard:** With this option, the energy discharge occurs at nearly the same time as the tip lifts off the workpiece surface. This mode is perfect for metal types that do not require a preheat phase during the weld. Because the electrode is closer to the workpiece, the electrode may dull more quickly. Standard ignition mode is typically used for welding fine applications that may be damaged by high energy levels since there is no pre-ignition arc.



- **Standard+:** In Standard+ ignition mode, the energy discharge occurs well after the electrode tip lifts off the workpiece surface. While similar to the Standard option, Standard+ includes a "pre-heat" function known as a "focus arc" before the main weld. As the electrode begins to pull away from the surface, a small amount of energy is discharged prior to the main weld discharge. This additional energy helps preheat the weld area and helps establish an arc when the electrode is further away from the surface. The Standard+ ignition helps provide better weld consistency by allowing more variation in contact pressure before the weld takes place.



- **Adaptive:** In adaptive ignition mode, the arc can be maintained for longer periods of time in order to adapt to variations in workpiece positioning techniques from user to user. This mode is more forgiving of movement of the workpiece during arc formation. Initially, however, more energy is released into the workpiece than in the other modes and can be detrimental for smaller weld applications or heat sensitive metals.

## Agitation

During the weld, a high-frequency agitation feature can be used to improve weld formation and strength in certain applications. Positive agitation is added energy to the weld in the form of micro energy bursts. Negative agitation is subtracted energy from the weld in the form of micro energy pockets. These energy bursts occur at a rate of up to 10,000 times per second. Using agitation can produce an audible, high-pitched “ping” noise. Additional agitation settings can be found in the Settings Screen or using the Mini-Screen.



- **None:** With None selected, no agitation is added to the weld. This is the standard weld discharge curve with a smooth slope.



- **Negative:** Negative agitation decreases the overall energy of the weld and has the same peak voltage of the weld without agitation. This can be useful to minimize porosity of the weld.



- **Sloped:** The Sloped agitation option offers low levels of agitation. It has minimal impact on spot size formation, but yields additional penetration and enhanced weld strength. This agitation is available for all welds with 231 Ws of energy or less.



- **Sustained:** The Sustained agitation option offers high levels of agitation for improved weld spot strength in some metals. The high levels of agitation energy will affect the spot size because of the extra energy used in this option. To compensate for this addition of agitation energy, you may need to slightly lower the overall weld energy when using this option. This agitation is available for all welds with 132 Ws of energy or less.

## Power/ Energy Slider

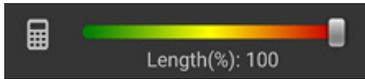


Use the Power/Energy Slider to adjust the amount of weld energy or weld power that will be discharged depending on the waveform selected.

- You can touch or drag the slider to adjust the value.
- Pressing on the keypad icon will bring up a keypad for entering exact values. On the keypad, type in the desired value and press enter. The value on the slider will change and the keypad will disappear.
- As the setting increases it will lead to more forceful welds, more heat at the weld site, deeper penetration, and larger spot sizes.
- It can be helpful to start at lower values and gradually increase to higher values to fine tune the weld results without damaging the workpiece.

## Length Slider

Use the Length Slider to adjust the duration of time for each weld energy discharge.



- When using the Classic waveform mode, the length should typically be set to 100% for most weld applications. This allows the weld puddle to cool at the proper rate and will result in smoother weld spots.
- In the Triangle and Square waveform modes, changing the length of the weld has a much bigger impact on weld results. Longer length settings lead to more heat at the weld-site and generally result in bigger spot sizes/deeper welds.
- Experimentation with different lengths and power settings can help achieve the best results when using Triangle and Square modes.

## TACK CONTROL LAYOUT

The Sunstone Omega PA250i is capable of performing resistance tack welds. See the Make a Tack Weld section on page 41 for more information.

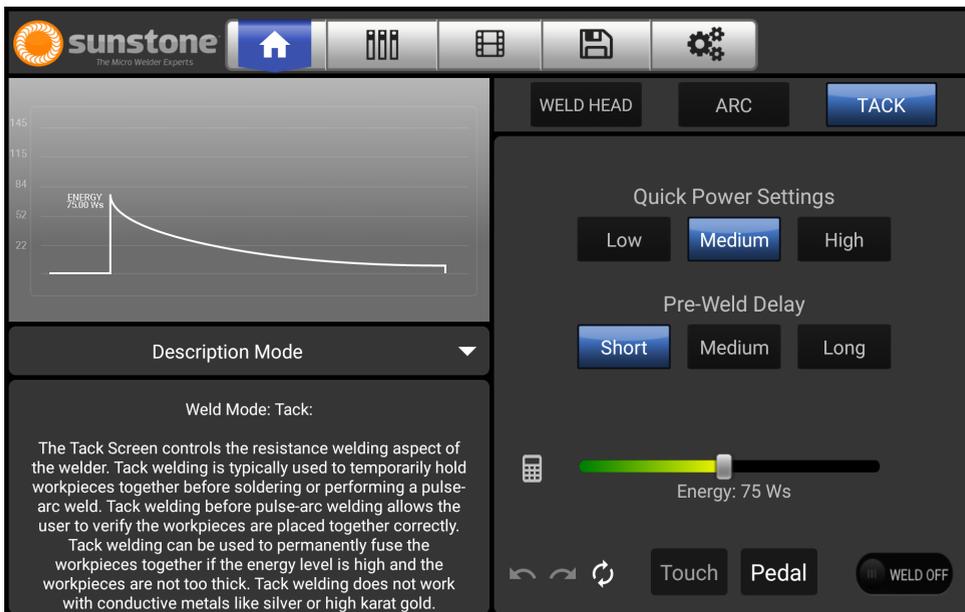


Figure 23.1. When you touch "TACK", the button will turn blue and new parameter controls will appear for resistance tack welding.

### Quick Power Settings

These buttons, shown in Figure 23.1, allow you to quickly set the power to one of three common settings.

- **Low:** Tack energy is set to 30 Ws.
- **Medium:** Tack energy is set to half its maximum.
- **High:** Tack energy is set to maximum.

### Pre-Weld delay

These buttons set the time between weld trigger and weld initiation.

- **Short:** Sets a quarter second delay before initiating the weld.
- **Medium:** Sets a half a second delay before initiating the weld.
- **Long:** Sets a one second delay before initiating the weld.

## Tack Energy Slider

The Tack Energy Slider adjusts the amount of weld energy that is being used. In order to precisely adjust the energy, click the keypad icon to enter keypad mode.

## Footer Buttons

The buttons along the bottom of the Parameter Area are displayed at all times.

- **Weld ON/OFF:** Pressing the icon toggles between Weld OFF and Weld ON. If the icon shows Weld ON, the weld sequence can be initiated. When the icon shows Weld OFF, energy is not released.
- **Undo:** The Undo icon allows you to go back through the five (5) previous settings changed.
- **Redo:** The Redo icon allows you to cycle forward after pressing undo.
- **Reset:** The Reset icon resets all the variables and parameters to the factory default settings. The Reset feature does not affect any saved settings, only the on-screen settings on the Home Screen.
- **Touch Detect:** In Touch Detect, the welder will initiate the weld process any time that a grounded workpiece contacts the electrode (or with the opposite grounded workpiece when in Tack mode). When this button is selected, the Pedal Button will be grayed out.
- **Foot Pedal:** When Foot Pedal is selected, the welder will only initiate when the foot pedal is pressed. Move the grounded workpiece into contact with the electrode, hold still, and use your foot to press the foot pedal to initiate the weld. This can be useful for the ability to weld complex parts without worrying about accidentally triggering a weld before getting into position. When this button is selected, the Touch Button will be grayed out.

## MINI-SCREEN AREA

The Mini-Screen Area allows you to customize the Home Screen by choosing from a list of modes that will be displayed for quick access to various weld control parameters, system settings, and information without leaving the Home Screen. See Figure 25.1 as an example of a Mini-Screen. Touch the drop-down arrow to view a list of viewable options. The current option is highlighted in blue. There are different options based on whether you are in Weld Head, Arc, or Tack screen.

## Weld Parameters

- **Weld Head Options:** This Mini-Screen is only available in Weld Head mode. Adjust the Lift-off Delay, Tip Descend Delay, and Tip Retract Distance.
  - **Lift-off Delay ( $\mu$ s)** controls the time between tip retraction and weld. Lower values produce better arc ignition consistency, but contaminate the electrode tip easily, resulting in shorter tip life. Higher values increase the tip life, at a cost of lower arc ignition consistency.

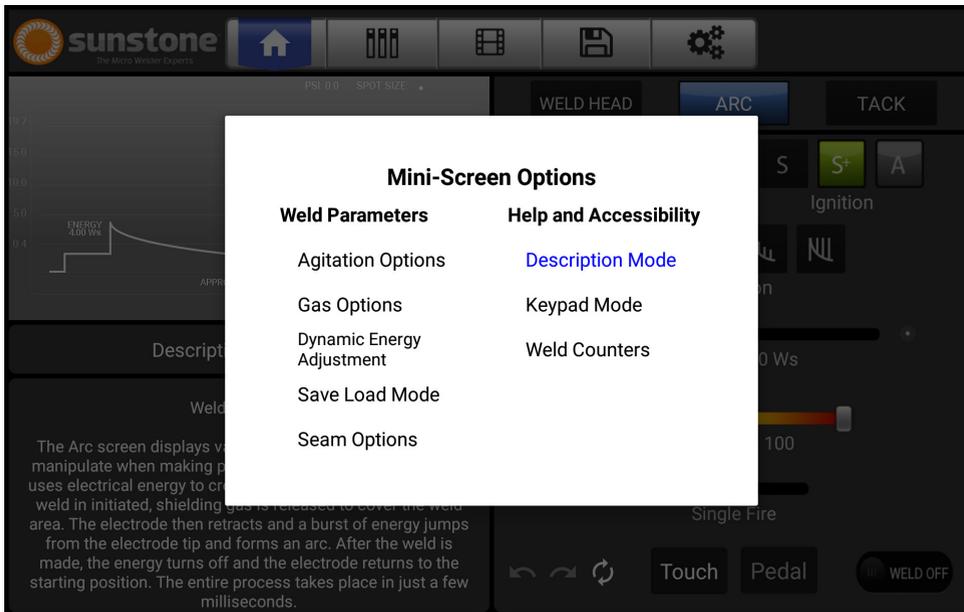


Figure 25.1. You are able to customize the information displayed in the Mini-Screen Area. Touch the drop down arrow to view a list of available options.

- If you notice that your weld head is frequently misfiring, check your tip shape first, but then you should try adjusting this value down. Try to only adjust by 100-200 $\mu$ s at a time, because this delay can make a big difference.
- If you notice your electrode is sticking to the surface frequently, or that you are getting too much contamination on your tip, try increasing this value. Adjust by 100-200 $\mu$ s at a time, because this delay can make a big difference.
  - **Tip Descend Delay (ms):** This parameter is primarily useful for a manual (non-CNC) weld head. Adjust this value to give sufficient time for the nose cone to descend before the electrode begins descending to make a weld.
  - **Tip Retract Distance (mm):** This parameter controls how far the tip will be off the surface after a weld occurs. Lower values can be used for smoother surfaces. Higher values can be used for rough surfaces or if weld spots are close together.
- **Agitation Options:** Adjust the agitation frequency, duty cycle, and weld percentage.
- **Gas Options:** View gas pressure gauge and adjust gas flow timing. Tapping on the gas gauge will cause a purge of the gas line. When accessing this Mini-Screen from the Weld Head screen, an option labeled Continuous Gas Flow is available. Enable this setting if a separate shielding gas system is set up, as this setting will cause the welder to not regulate the gas, allowing faster welding rates. For more information about Gas Options, see page 34.
- **Dynamic Energy Adjustment Mode:** This Mini-Screen is only available in Arc mode. Enable or Disable the mode and adjust the desired percentage. When this mode is active, operators may press the foot pedal to momentarily change the weld energy by the set percentage. You can choose to increase or decrease the weld energy by up to 50% while the foot pedal is pressed. This can be useful for making

energy adjustments without using hands or looking away from the scope. Touch detect triggering is required when Dynamic Energy Adjustment mode is enabled.

- **Save Load Mode:** Access to saving/loading settings (see the Save/Load Screen section on page 32).
- **Seam Options:** This Mini-Screen is only available in Arc mode. Use this screen to adjust the Seam Duration and the Seam Welds Per Second. Seam mode will attempt to do X number of welds in Y seconds, where X is the Seam Welds Per Second, and Y is the Seam Duration. This will release a lot of energy over the course of the seam weld, so **be aware the workpiece and handpiece can get hot.**

## Help and Accessibility

- **Description Mode:** A short description will appear for various buttons/sliders when they are in use.
- **Keypad Mode:** The numbered keypad will stay visible when this mode is selected.
- **Weld Counters:** View and reset weld counters. Two weld counters are available. Press the respective Reset Weld Count Buttons to return counter values to zero.

## Communication Screen

Pressing this icon will open up the Communication Screen. The Communication Screen has three different sub-screens: the PLC Screen, the Remote Schedule Select Screen, and the Active Alarms Screen.

### PLC SCREEN

The PLC Screen has three areas: The Connector Pinout, the PLC Outputs, and the PLC Inputs. See Figure 26.1.

#### Connector Pinout

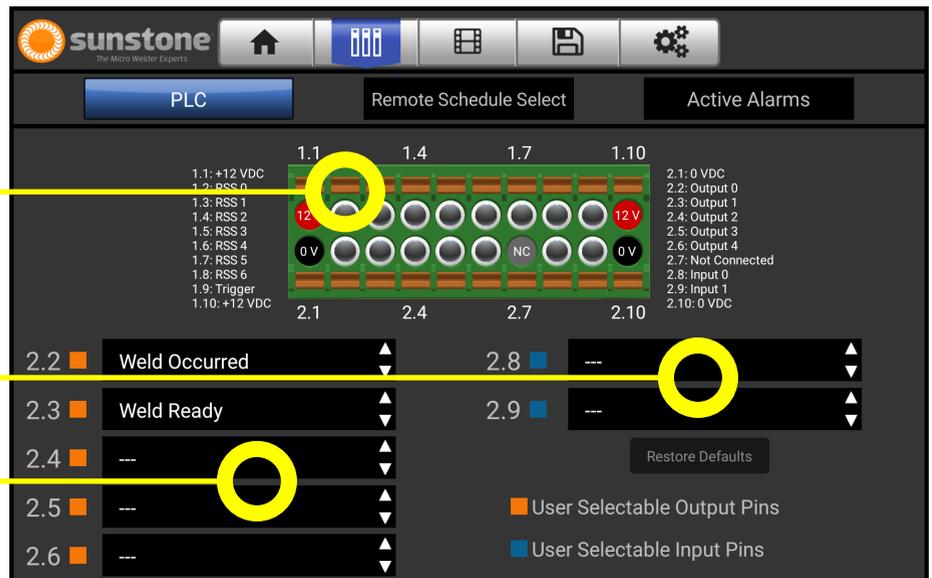
The top half of the PLC Screen shows the connector pinout. This will be beneficial for initial setup of your sys-

Figure 26.1. In the Communications Screen, when you touch the PLC Button, the screen is organized into three main areas:

Connector Pinout

PLC Inputs

PLC Options



tem, if using a PLC. This pinout shows where the various signals would be transmitted from or transmitted to. This diagram also shows locations for a 12V DC signal and a 0V DC signal, useful for reference. Please note that pin 2.7 is not connected internally and does not carry any signal.

## PLC Outputs

These five drop down options (pins 2.2 through 2.6) are used to customize what signals are output from the welder. Click on one of the arrows to open the drop-down and select one of the welder's 15 different outputs. The welder operates in an active-low configuration, so a value of 0V corresponds with true, and a nonzero value (12V typical) corresponds with false. An external +240VDC can be used for the output pins 2.2 through 2.6, referenced to pins 2.1 or 2.10 (GND/VDC). The current will need to be limited to ensure that each output does not exceed 500 mA of sunk current (which can be accomplished using a pull-up resistor value of 1k $\Omega$  to 10k $\Omega$ ). The output pins do not have internal pull-up resistors, for best results a resistance value of 1k $\Omega$  to 10k $\Omega$  between the output pin and 12V is recommended. The available PLC outputs are:

- **Welder State:** This output will go low (0V) when the unit is in a Weld On state, and will be pulled up to high (12V) when the unit is in the Weld Off or Dry Run states.
- **Weld Occurred:** This output will go low (0V) when the welder recognizes the energy in a weld has discharged and will remain low (0V) until a new weld is attempted.
- **Weld Ready:** This output will go low (0V) once the energy banks are charged to the required voltage and the electrode tip is not stuck to the work piece. They will remain low (0V) until a weld is attempted, or until you set a new energy value. If in Weld Head mode, Weld Ready will also depend on whether the weld head is connected and communicating with the PA250i.
- **Misfire:** This output will be low (0V) once the welder detects a weld was attempted but did not successfully discharge. It will remain low (0V) until a new weld is attempted.
- **Charging:** This output is low (0V) while the welder is actively charging/adjusting stored energy.
- **Alarm: Temperature:** This output will need to be enabled here or on the Active Alarms Screen before a value is output. This alarm will be low (0V) when the internal unit temperature exceeds your preset temperature threshold. When it crosses the temperature threshold, the internal fans will turn on to assist in cooling the unit down. Once the unit cools down to below the threshold, the fans will turn off and the output will be a high value (12V).
- **Alarm: Misfires In a Row:** This output will need to be enabled here or on the Active Alarms Screen before a value is output. This output will go low (0V) when the number of misfires in a row meets or exceeds your preset threshold, and will remain low until a weld successfully discharges, or the threshold is raised.
- **Alarm: Weld Counter 1:** This output will need to be enabled here or on the Active Alarms Screen before a value is output. This output will go low (0V) when the number of welds meets or exceeds your preset threshold, and will remain low until Weld Counter 1 is cleared, or the threshold is raised.
- **Alarm: Weld Counter 2:** This output will need to be enabled here or on the Active Alarms Screen before a value is output. This output will go low (0V) when the number of welds meets or exceeds your preset threshold, and will remain low until Weld Counter 2 is cleared, or the threshold is raised.

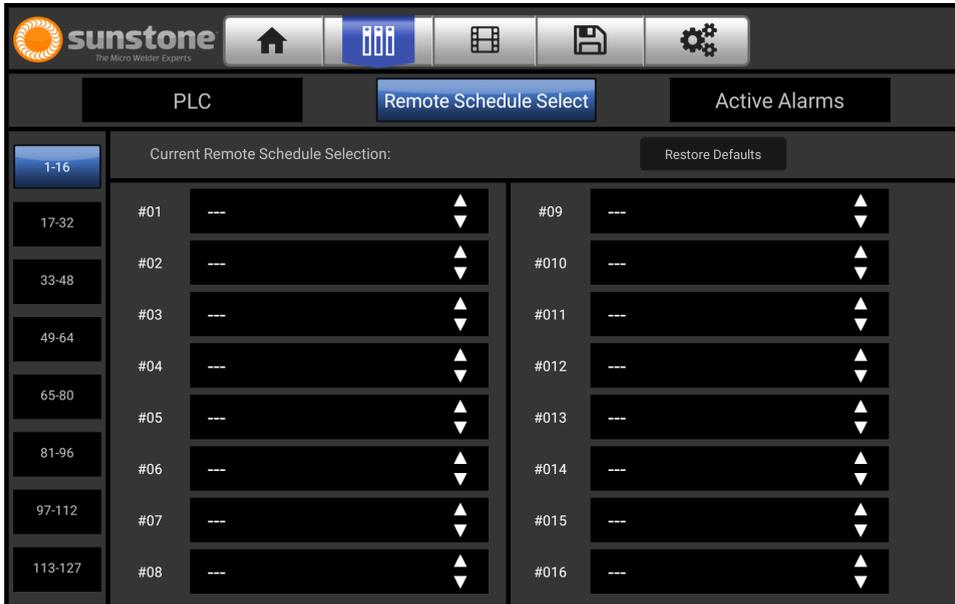
- **Alarm: Gas Pressure Low:** This output will need to be enabled here or on the Active Alarms Screen before a value is output. This output will go low (0V) when the gas pressure is less than or equal to your preset threshold, and will remain low until the gas pressure raises above the threshold, or the threshold is lowered. As insufficient gas pressure can negatively impact weld quality, this is primarily used to monitor when gas tanks need replacing.
- **Alarm: Gas Pressure High:** This output is enabled here or on the Active Alarms Screen before a value is output. This output will go low (0V) when the gas pressure is greater than or equal to your preset threshold value, and will remain low until the gas pressure is decreased, or the threshold is raised.
- **Alarm: General Gas Pressure:** This output will need to be enabled here or on the Active Alarms Screen before a value is output. This output will go low (0V) when the gas pressure is less than or equal to your preset low threshold value, or greater than or equal to your preset high threshold value. This potentially saves PLC pins for other needs.
- **Error:** This output does not need to be enabled by you and will go low (0V) when an internal error occurs. Such internal errors could include charge errors, too high of voltage on the welding terminals, or potentially damaging internal temperatures. This is to signal you to turn off the machine, and if problems persist, to contact Sunstone Support.
- **Error: Electrode Stuck:** This output will go low (0V) when the welder detects the electrode is stuck to the workpiece, and will stay low until the workpiece and electrode are separated. This is a critical error when automating the welder, as trying to move a stuck electrode can cause damage to the workpiece.
- **Error: Invalid Remote Schedule Selection:** This output will go low (0V) when an unassigned remote schedule is selected. For more information, see the Remote Schedule Select section on page 29.

## PLC Inputs

These two drop downs (pins 2.8 and 2.9) are used to customize what inputs the welder accepts. Click on one of the arrows to open the drop-down and select one of the Sunstone PA250i's 5 different inputs. The Sunstone PA250i's PLC operates in an active-low configuration, so a value of 0V corresponds with true, and a nonzero value (12V typical) corresponds with false. Inputs have an internal pull-up resistance to +12VDC limiting current to 25mA. Pins 2.1 and 2.10 can be used to pull the inputs to 0VDC (GND). The available inputs are:

- **Toggle Weld On/Off:** Drive this input to 0V to toggle the weld state between Weld On and Weld Off. For those using Weld Head mode, this input does not toggle to Dry Run state.
- **Reset Weld Count 1:** Drive this input to 0V to reset the first weld count.
- **Reset Weld Count 2:** Drive this input to 0V to reset the second weld count.
- **Reset Both Weld Counts:** Drive this input to 0V to reset both weld counts.
- **Purge Gas:** Drive this input to 0V to purge the shielding gas (typically Argon). This is beneficial if there are breaks between welding, or if you are noticing black residue around your weld sites.

The Sunstone PA250i also has a dedicated Weld Trigger input, assigned to pin 1.9. This pin also operates in an active-low configuration, drive this input to 0V to trigger a weld. (if in Arc or Tack mode make sure your trigger method is set to Foot Pedal).



*Figure 29.1. The Remote Schedule Select Screen allows you to save up to 127 different welds and select any one of them remotely.*

## REMOTE SCHEDULE SELECT

The Sunstone PA250i contains an advanced Remote Schedule Select Screen (see Figure 29.1), allowing you to assign up to 127 saved welds, and remotely select which one to use. Welds must be saved before they can be assigned on this screen (see the Save/Load Screen section on page 32 for more information on saving welds).

### Assigning Saved Welds

The 127 available slots are broken up into 7 groups of 16, and 1 group of 15. Use the buttons on the left of the screen to select the various ranges of remote schedules, and the numbered drop downs to the right to select what saved weld name is assigned to that number.

### Selecting Assigned Weld Schedules

Pins 1.2 through 1.8 (refer to the Connector Pinout on page 27 for more information on pin locations) are all used for Remote Schedule Select. Like the PLC inputs, they too operate in active-low configurations, where a low value (0V) is used for selecting. These pins also have an internal limiting pull up resistor to limit current.

These seven pins are bit mapped into a number between 0 and 127, with RSS 6 (pin 1.8) being the most significant bit. The bit-mapped number will then load the corresponding Remote Schedule Select (RSS) slot. For example, if RSS0 (pin 1.2) and RSS1 (pin 1.3) are driven low while the rest remain high, read in as a number 1111100, because the unit operates in an active-low configuration, and is therefore interpreted by the unit to be 0b0000011, or slot number 3. If the RSS tries selecting a slot that does not have a weld assigned, the following message will appear: "Error: Invalid Remote Schedule Selection".

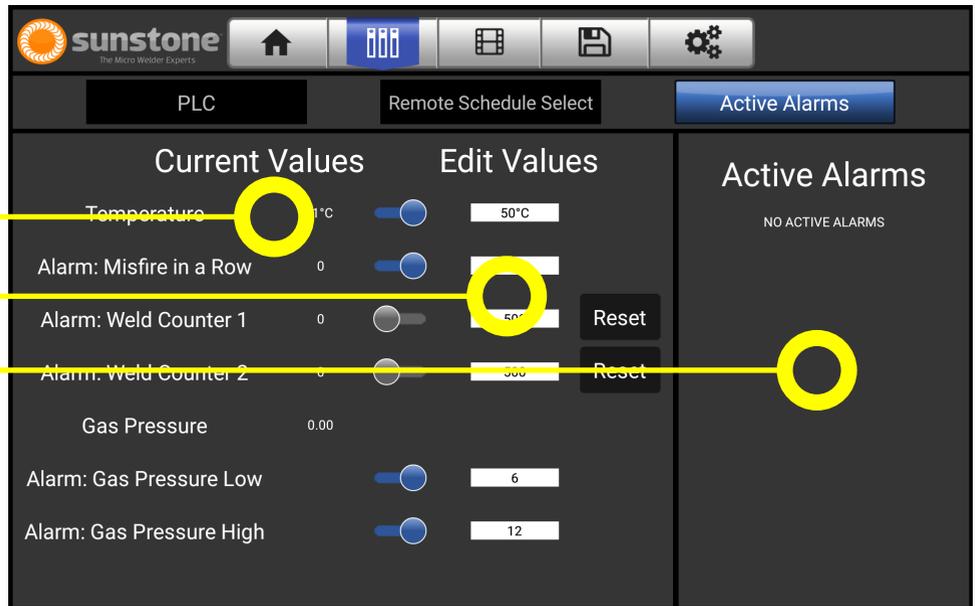
When the RSS loads any numbered slot, the user interface (or UI) is locked, preventing you from changing settings away from what the RSS loaded. If no pins are being driven low, the RSS is disabled, and the UI is unlocked so settings can be changed.

Figure 30.1. The Active Alarms Screen is organized into three main areas:

Current Values

Edit Values

Active Alarms



## ACTIVE ALARMS

The Active Alarms Screen has three primary areas (see Figure 30.1). Current Values displays the current values that could trigger an alarm. Edit Values allows you to change the alarm trigger thresholds. Active Alarms displays what alarms are currently triggered. Individual alarms can be enabled or disabled using the rocker switch on the screen. Simply touch the switch to toggle between enabled and disabled. The thresholds that the various alarms can occur can be edited by touching the box under the Edit Values column and entering a new value. When the circle is gray and to the left, the alarm is disabled. Move the circle to the right to enable the alarm.

The PA250i has six different alarms:

- **Temperature:** This alarm will notify you once the internal temperature crosses your preset temperature threshold. When the alarm is active and enabled, the fans will turn on. Sunstone has also programmed in critical temperature value thresholds, where the fans will turn on regardless of alarm status, and in event of critically high temperatures, welding will be disabled. Once the temperature decreases below the threshold, the alarm will be inactive.
- **Misfires in a Row:** This alarm will notify you once the number of weld misfires in a row crosses your preset threshold. The unit considers it a misfire when it detects a weld was attempted but the weld energy did not successfully discharge. Once a weld successfully discharges, this count will reset to 0 and the alarm will be inactive.
- **Alarm: Weld Counter 1:** This alarm will notify you once the number of welds crosses your preset threshold. This counter will only reset to 0 when the Reset Button is pressed, which will also deactivate the alarm.
- **Alarm: Weld Counter 2:** This alarm will notify you once the number of welds crosses your preset threshold. This counter will only reset to 0 when the Reset Button is pressed, which will also deactivate the alarm.

- **Alarm: Gas Pressure Low:** This alarm will notify you once the shielding gas pressure is lower than you preset threshold. This alarm will go inactive once the gas pressure is raised to be above the threshold value.
- **Alarm: Gas Pressure High:** This alarm will notify you once the shielding gas pressure is higher than your preset threshold. This alarm will go inactive once the gas pressure is lowered to be below the threshold value.

Alarms that are enabled and active will be displayed under the Active Alarms column.

## Media Screen

The Sunstone PA250i has preloaded media that can be viewed from the Media Screen for help and information regarding welding (see Figure 31.1). The Users Manual can also be found here.

- Press on the desired drop down box on the left to expand the lists of viewable content.
- Press on one of the file names to bring up the media in the viewing area.
- Press the Play icon to begin viewing the file, Pause to stop, or press the arrows to advance or rewind.
- Clicking on the video will also play and pause it.
- The volume can be adjusted using the slider or muted by tapping the Volume icon.
- The files can be viewed in full screen as well.
- The Load Recommended Weld Settings Button can be pressed if settings used in video are desired to be used on the Sunstone PA250i.

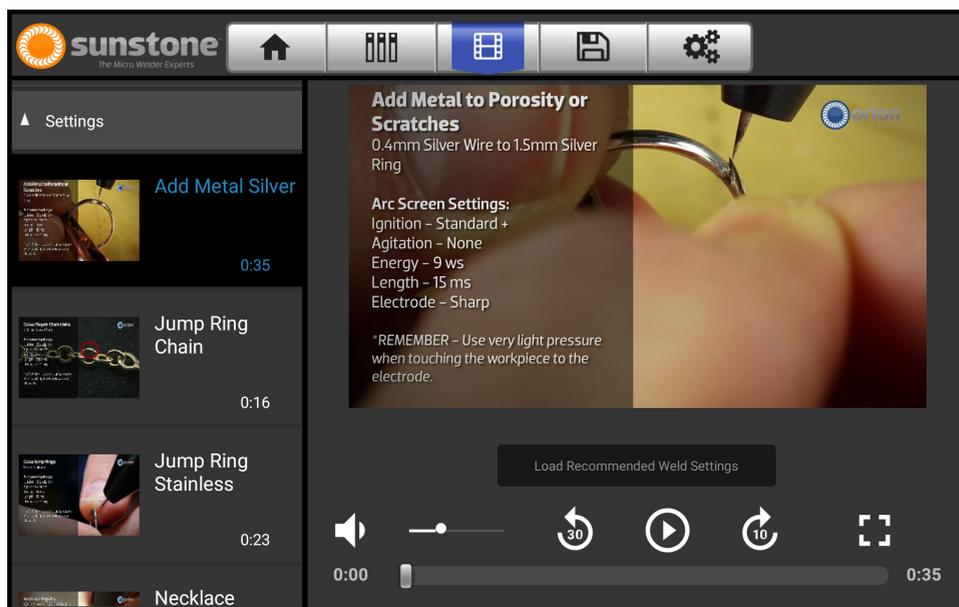


Figure 31.1. The Sunstone PA250i comes preloaded with instructional video and documentation.

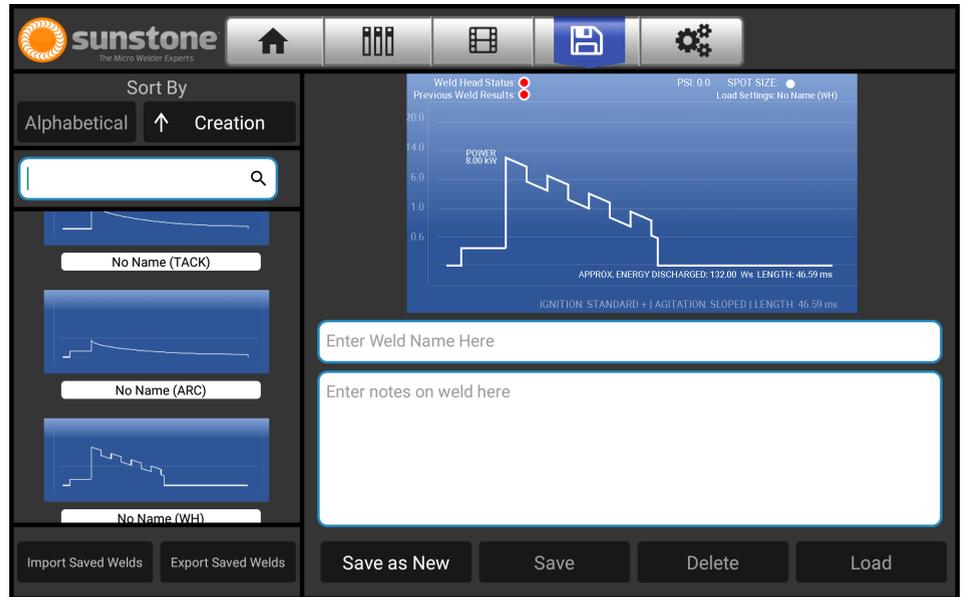


Figure 32.1. With the Sunstone PA250i you can save any weld setting for future use.

## Save/Load Screen

The Sunstone PA250i can save and load your weld settings for future use. To save your current weld parameters, press the Save icon to open the Save/Load Screen (see Figure 32.1).

### SAVE SETTINGS

The parameters will be represented in the graphic waveform window. Three different weld types can be saved: Arc, Tack, and Weld Head.

- Click on the field below the wave form graph to enter a name for the saved weld settings. i.e. "16 Awg stranded wire" or ".015" copper tab to a power cell." The keypad will automatically pull up.
- Enter any notes regarding the weld process if desired in the area under the weld name.
- Click the Save as New Button. This stores the file for retrieval at a later date. The saved file will appear in the column on the left.
- Click the Save Button to save the current settings over another already saved weld setting.

### LOAD SETTINGS

Saved Weld Setting files can be loaded (the weld settings will all change to whatever had been saved).

- Look for the desired file in the column on the left side or search for the file name by entering it into the search box.
- Press Alphabetical to sort the list by starting letter or Creation to sort the list by order created. Pressing either button again will reverse the order listed, i.e. (a-z, z-a).
- Pressing on the file name will bring it up in the graph window.
- Press the Load Button and the settings will be applied to the welder and return to the Home Screen.

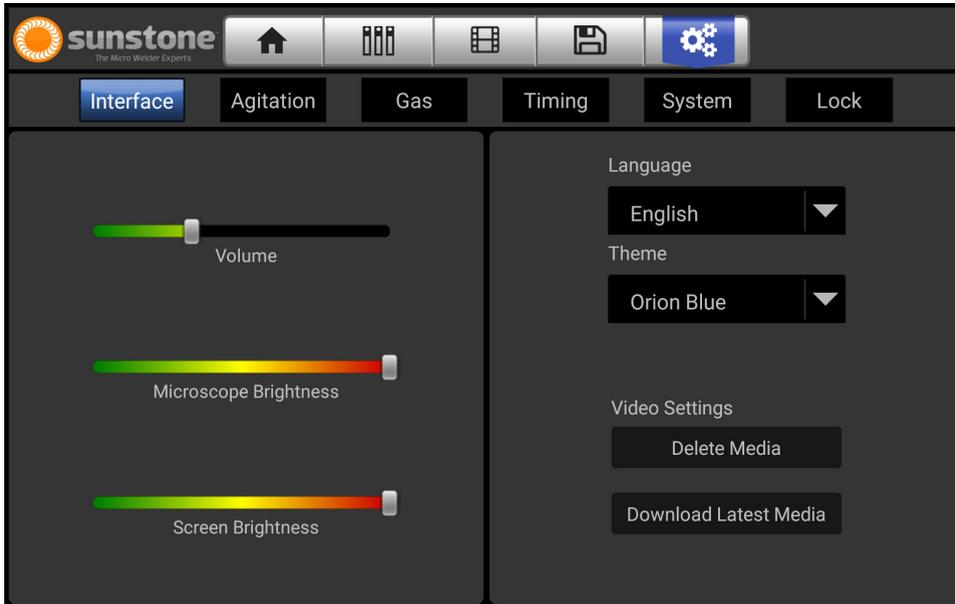


Figure 33.1. Touch the Settings Button in the Navigation Bar to access and adjust various system settings and weld parameters

## Settings Screen

The Settings Screen provides access to various system settings and weld parameter settings, and can be accessed by pressing the gears icon in the top right of the display. A row of buttons lists the configurable features.

*Note: The Gas and Timing screens change depending upon the type of weld selected: Arc, Tack, or Weld Head.*

Clicking on any of the settings buttons (shown in image above) will bring up the available options in that category as described below:

### INTERFACE OPTIONS

- **Volume Slider:** This slider adjusts the volume of system sounds.
- **Microscope Brightness Slider:** This slider will increase or decrease the brightness of the LED lights on the bottom of the microscope.
- **Screen Brightness Slider:** Adjust the brightness of the screen as desired.
- **Language Selection Drop Down Box:** The Sunstone PA250i comes preloaded with several language options. Press the down arrow to display a list of languages. Select the desired language and all instructions will be displayed in the selected language.
- **Theme Selection Drop Down Box:** The Sunstone PA250i has two different thematic color schemes. (Orion Blue or Sunstone Orange) Press on the desired color from the drop-down box.
- **Video Settings Buttons:** Press the Delete Media Button to clear all media from memory.
- **Download Latest Media:** Press the Download Latest Media Button (if WiFi is available) to connect to the Sunstone website for the all related media files. If a new file or an updated file exists on the server, it will be downloaded.

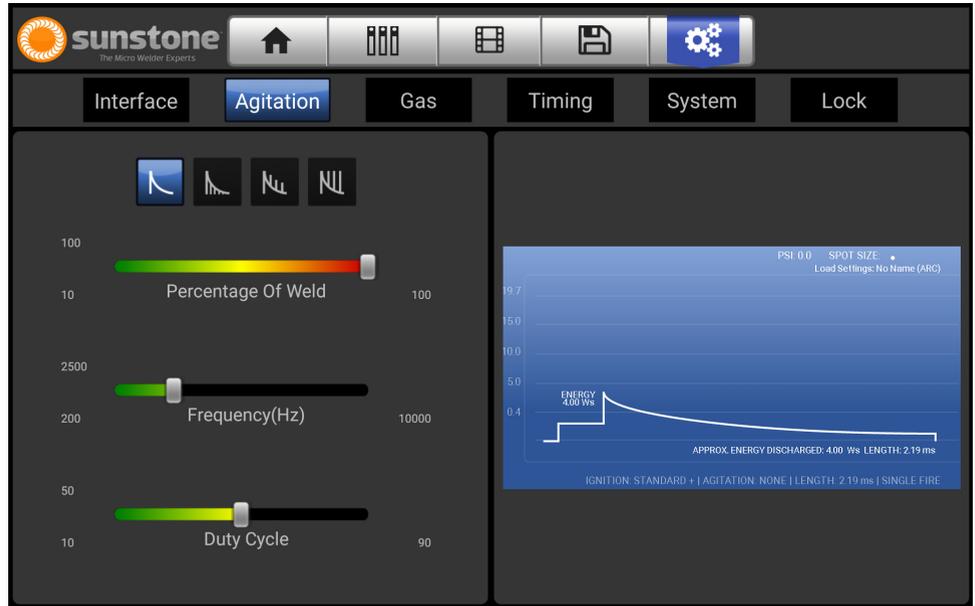


Figure 34.1. Touch the Agitation Button to globally adjust the parameters for agitation.

## AGITATION OPTIONS

Each slider has + and – buttons that will appear for five seconds after the slider has been adjusted.

- **Agitation Profile Buttons:** Press the button for the desired agitation profile (see the Agitation section on page 22). Available profiles are None, Negative, Sloped, and Sustained.
- **Percentage of Weld Slider:** Allows you to set the duration of the agitation spikes in relation to the length of the weld. At 100%, the agitation spikes will last for the entire discharge of weld energy. At anything less than 100%, the percentage is measured from the start of the weld.
- **Frequency Slider:** Allows you to adjust the frequency (Hz) of the agitation spikes. Typically, values of around 2500Hz are ideal for good weld results, but different metals may require different values. Higher frequencies will help break up crystalline structures during cooling.
- **Duty Cycle Slider:** Higher duty cycle means more spikes will occur during the weld, and also means less time between spikes. Higher duty cycles will add more energy to the weld than lower duty cycles.
- **Graphic Display Window:** The right side of the screen displays the updated waveform as the various settings on the left are adjusted. The waveform is for reference only and is displayed based on using a set system resistance.

## GAS OPTIONS

Each slider has + and – buttons that will appear for five seconds after the slider has been adjusted.

- **Pre-Flow Delay Slider:** Allows you to set how long the gas will be on before the weld initiates. The welder will automatically increase this time if a weld hasn't occurred for a given time in order to purge the line and decrease oxygen at the weld location.

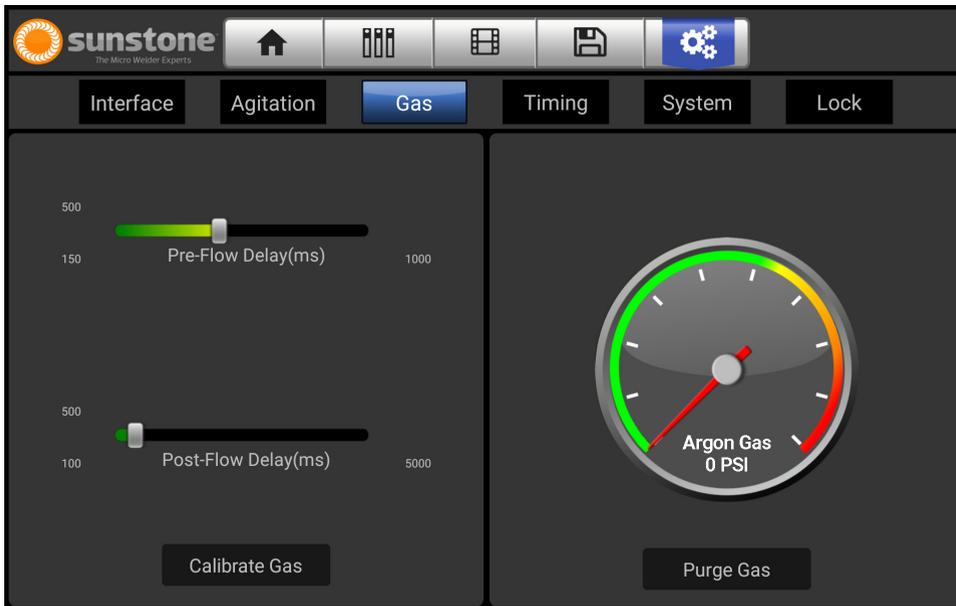


Figure 35.1. The Sunstone PA250i will digitally display the status of the gas attached to the welder. Touch the Gas Button to calibrate, purge, or adjust other gas-related settings.

- **Post-Flow Delay Slider:** Allows you to set how long the gas will remain on after a weld has taken place. Longer delays are useful for metals that oxidize quickly, such as titanium, where oxygen will cause cracks while the molten metal is cooling.
- **Calibrate Gas Button:** Allows you to recalibrate the gas pressure to make sure the gas read out is accurate. To calibrate, turn off the gas tank, disconnect the gas from the back of the Power Supply and press the button. Then re-attach the gas to complete the calibration.
- **PSI Gauge:** Graphic representation of shield gas pressure.
- **Purge Gas Button:** Allows you to purge the line of air and or gas; useful for pressurization and to check gas flow.

## TIMING OPTIONS

Each slider has + and – buttons that will appear for five seconds after the slider has been adjusted. This screen is only available in Arc and Tack modes (see Figure 36.1). When the system is in Weld Head mode this button will be grayed out.

- **Pre-Weld Delay Slider:** Modifies the delay time between weld initiation (touch detect or foot pedal press) and the actual arc formation. This can provide operators extra time to ensure correct position of electrode.
- **Lift-off Delay Slider:** Adjusts the timing of the weld discharge (arc formation) in relation to the position of the electrode as it retracts. The longer the delay, the further away from the workpiece the electrode will be when the arc forms. Longer delay times can help improve electrode life, but may lead to increased difficulty in starting or maintaining the arc (aborted welds). Longer delay times can also increase weld spot size inconsistencies.

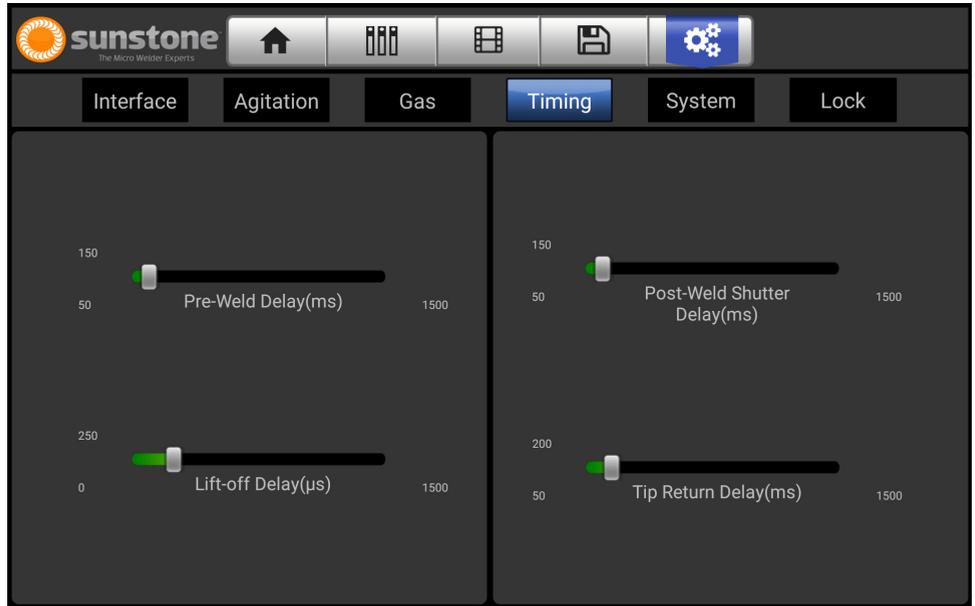


Figure 36.1. Touch the Timing Button to adjust various system timings.

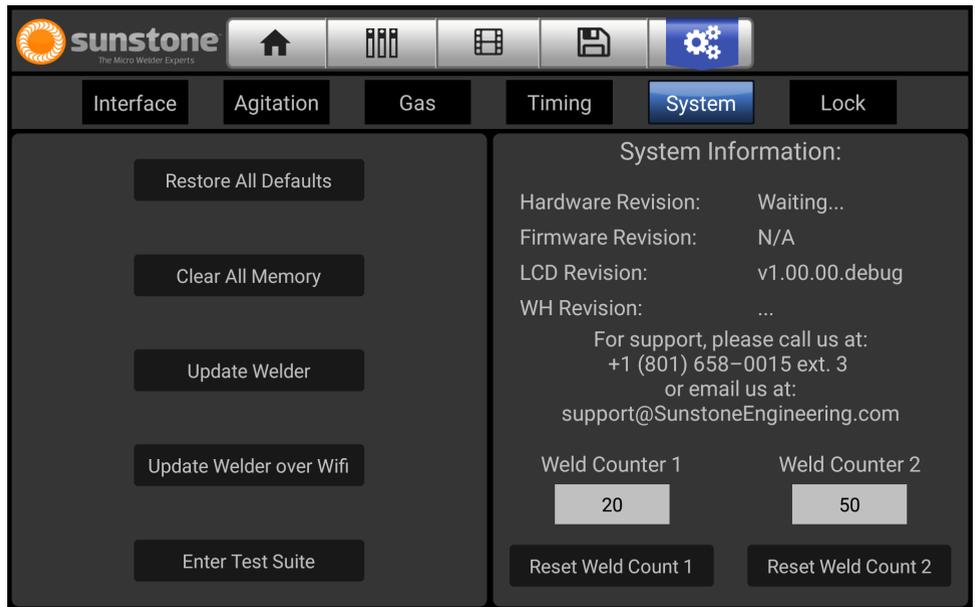


Figure 36.2. Touch the Systems Button to restore defaults, update the welder's software, clear memory, and view revision numbers.

- **Post-Weld Shutter Delay Slider:** Adjusts the length of time the shutter stays darkened after a weld.
- **Tip Return Delay Slider:** Adjusts the amount of time that the electrode will stay retracted after a weld takes place. Low values allow operators to quickly initiate the next weld, high values allow for time to adjust workpieces with complex geometries without worrying about accidentally starting another weld.

## SYSTEM OPTIONS

See Figure 36.2 when referencing the following features:

- **Restore All Defaults:** Allows you to restore the weld settings to the original Sunstone default state.
- **Clear All Memory:** Restores all settings to default and clears memory of any saved welds, weld counts, gas pressure warnings and other stored information.
- **Update Welder:** Allows you to update the system using a file stored on an SD card. Insert the SD card into the slot on the back of the Touchscreen while the unit is off. Turn unit on and navigate to this screen and then press the Update Welder Button to initiate the process. Do not remove the SD card from the slot unless the welder is off.
- **Update Welder over WiFi:** Allows you to update the system from the Sunstone server via WiFi.
- **Enter Test Suite:** This button is for Sunstone Tech Support diagnostics and requires a password to enter.
- **Hardware Revision:** Displays the revision number of the control board.
- **Firmware Revision:** Displays the revision number of the control board's firmware.
- **LCD Revision:** Displays the revision number of the LCD.
- **EV Revision:** Displays the revision number of the welder then connected.
- **Support Information:** Displays contact information for Sunstone Support team.
- **Weld Counters:** Two weld counters are available. Press the respective Reset Weld Count Buttons to return counter values to zero.

## LOCK OPTIONS

The Sunstone PA250i interface can be Locked to prevent changes to the settings and weld parameters. Refer to Figure 38.1 when referencing the following features:

### Toggle Lock Mode

- Press this button to lock the screen. A four-digit PIN code will need to be entered (or created if this is the first time locking the interface). If your pin is forgotten call Sunstone Tech Support at 801-658-0015 to have the PIN cleared.
- A Lock icon will appear in the upper right corner of the screen. Pressing this icon will display the keypad to enter the pin for unlocking.
- Each interface screen will still be available for viewing, but no changes will be able to be made until it is unlocked. Weld settings can be loaded during a locked state.

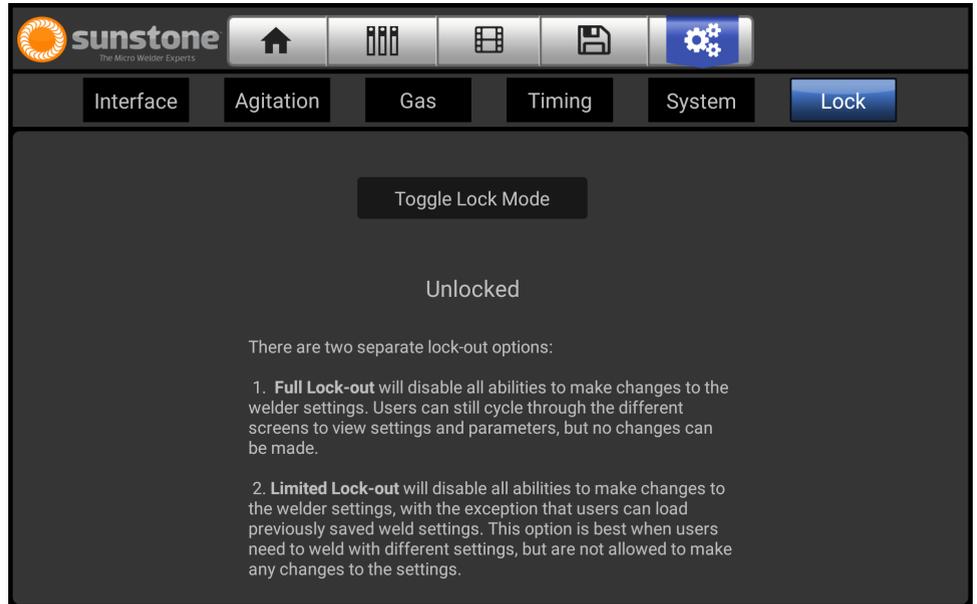


Figure 38.1. Touch the Lock Button to lock or unlock the welder. When locked, the PA250i will discharge energy but the current weld setting can not be changed. A PIN is used to lock and unlock the welder.

## Unlock Interface

- To unlock the interface, press the Lock Button in the upper right corner of the interface, or try to modify a value and enter the pin from a popup that will subsequently appear.

## UPDATING WELDER SOFTWARE

Depending upon the customer service plan you purchased for your welder, you may be able to receive software and welder setting updates via email. As Sunstone develops new software with more efficient settings and/or features to provide the very best welding experience, these updates will be available on the Sunstone website for download.

### Update via SD Card:

- Download update ZIP file from website or email.
- Unzip file, which produces files called "PA250i-UPDATE-vX.XX.XX.apk"
- Plug SD Card into computer then place the files in the root directory of the SD Card. (Do not place the files into any subdirectory or folder on the SD Card and do not rename the update file or the welder will not be able to perform the update.)
- While the welder is off, plug the SD card into the SD Card slot on the back of the Touchscreen.
- Turn the welder on.
- Go to the Settings Screen, by pressing the icon on the top right of the screen.
- Press the Update Welder Button.

- A popup will appear, informing you that the welder is copying the update file.
- A new popup will appear, asking if you would like to install the update. Press Install Button.
- A progress bar will show that the update is installing. Close the popup when the installation is complete.
- Turn off the Power Supply by pressing the Power Button and then touch Power Off on the Touchscreen.
- The welder will turn itself back on. Wait for it to boot up.
- A "Firmware Updating" popup will appear. Once the firmware is done updating, the unit will turn itself off.
- At this point the welder is ready to be turned on and used. The update is complete.

### **Update via WiFi:**

- Go to the Settings Screen by pressing the gears icon on the top right of the screen.
- Press the System Button and press the Update Over WiFi Button (this will update the welder to the latest software available). WiFi passwords can be stored for future ease of use.
- A popup will appear, informing you that the welder is copying the update file.
- A new popup will appear, asking if you would like to install the update. Press the Install Button.
- A progress bar will show that the update is installing. Close the popup when the installation is complete.
- Turn off the welder by pressing the Power Button and then touch Power Off on the screen.
- The welder will turn itself back on. Wait for it to boot up.
- A "Firmware Updating" popup will appear. Once the firmware is done updating the unit will turn itself off.
- At this point the update is complete and the welder can be powered up.

## Chapter 3: Make a Weld

---

### Weld State Button

- Upon power up, the Waveform Graphic Area on the Home Screen will appear gray (see Figure 17.1)
- In order to create welds, the weld state button must be toggled to the Weld On position. The Waveform Graphic Area will no longer be grayed out.
- To return the unit to a non-welding state, simply toggle the button back to Weld Off.

### MAKE AN ARC WELD

*Note: A pulse-arc handpiece is used in this mode along with an alligator clip. Ensure the cable has a resistance of at least 20mΩ when using an arc cable not supplied by Sunstone. **Do NOT use tack cables for arc welds.** For more information on arc welding techniques and specifics, refer to Chapter 4 of the Sunstone Workbook.*

- Attach the alligator clip firmly to the corner of the provided stainless steel weld plate (or other practice material).
- On the Home Screen, Click the ARC tab to bring up the options (see Figure 41.1).
  - Select Classic waveform.
  - Select the S+ ignition.
  - Select No Agitation
  - Typically, length values of 100% are used.
  - Slide the Energy bar to the desired value (between 10 and 20 is a good place to start).
  - Press the Touch Button to enable touch detect.
  - Press the weld state button to toggle the welder to WELD ON. Remember to verify the gas pressure and microscope connection. Purging gas is recommended after initial setup.
- Adjust the arm to a comfortable height. For best stability, your hands should rest on the table while welding. See Figure 42.1.
- Look through the microscope and raise the workpiece toward the stylus until it contacts the electrode.
- Once contact is made between the electrode and grounded workpiece the weld will automatically initiate. The electrode will retract, and energy will be discharged to form an arc.

- Once the energy has discharged, the electrode will return to its original position.

*Important Tip: You will experience an initial tendency to continue to push upward as the electrode retracts. Instead, hold the workpiece still during the weld process. Once contact is made, maintain the workpiece's position until the weld is completed.*

*Pushing the workpiece up to follow the electrode as it moves away from the workpiece can cause the electrode to stick to the workpiece.*

*Conversely, pulling the workpiece away from the electrode can cancel the formation of the arc.*



Use the provided stainless steel weld plate (as shown above) as a guide to try different settings and practice weld placement. Make several welds on the weld plate to get comfortable with the stylus and the effects of different weld parameters.

*Ensure the weld cable has a resistance of at least 20mΩ when using an arc cable not supplied by Sunstone.*

## MAKE A TACK WELD

*For more information on Tack Settings see page 23.*

This mode requires the use of two alligator clips or other cables connected to the Tack+ and Tack- terminals on the back of the Power Supply.

*Note: Do not attempt to use the "Pulse Arc+" terminals for Tack Welds.*

- From the Home Screen, press the Tack Button to display the Tack Controls. See Figure 42.1.
- Select Medium from the Quick Power Settings row.

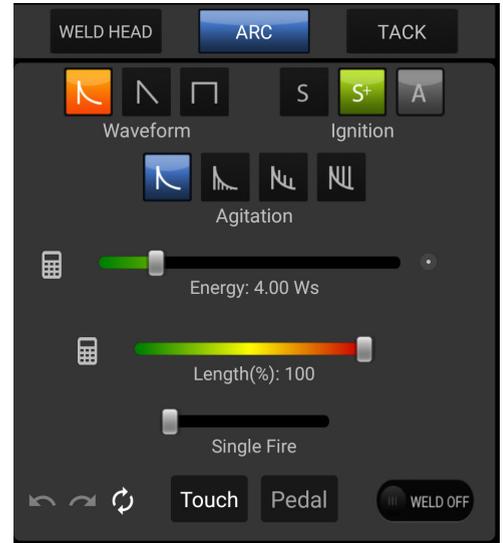


Figure 41.1. To make an arc weld, touch the ARC Button. Then select the desired waveform, ignition, and agitation. Adjust the amount of energy and length as needed. If you are using a pedal to initiate the weld, touch the Pedal Button; otherwise, the Touch Button is the default. Make sure the Weld On Button is on.

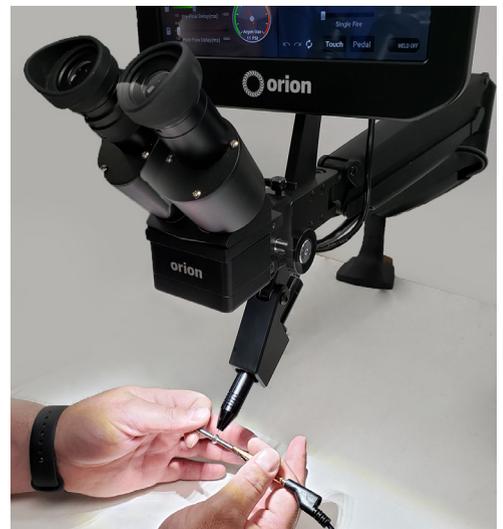


Figure 41.2. Adjust the arm to a comfortable height. Ideally your hands will be able to rest on the table while making welds for greatest stability.

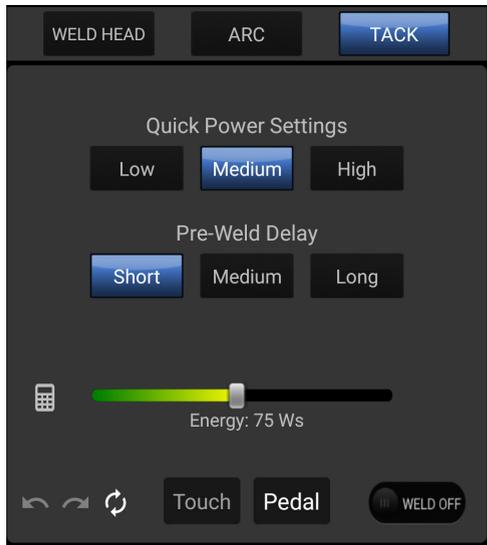


Figure 42.2. To utilize the welder's Tack mode feature, touch the Tack Button. Make sure alligator clips or other cables are attached to the Tack Terminal on the rear of the Power Supply. Select the desired power and delay settings. Adjust the energy level as needed. If you are using a pedal to initiate the weld, touch the Pedal Button; Make sure the Weld On Button is on.



Figure 42.2. In Tack mode, simply touch the two workpieces together to initiate the weld, as shown in the example above.

- Select Short from the Pre-Weld Delay row.
- Press the Pedal Button, and toggle the Weld On.
- Attach the negative alligator clip to one workpiece and the positive alligator clip to the other workpiece. See Figure 42.2.
- Lightly touch the two workpieces together where you want to tack them. See Figure 42.2. Too much pressure will result in a cooler weld, which can weaken the tack strength or result in an unsuccessful tack weld. Too little pressure can result in a hotter weld, and can cause arcing between the two surfaces and lead to sparks or poor tack quality.
- Step on the foot pedal to initiate the weld process. After the short weld delay, energy will discharge and the weld will occur. Try to maintain even pressure throughout the weld process.
- If the workpieces stay together, proceed to the Arc screen to perform a permanent weld using the Pulse Arc Welding Stylus. If the pieces do not stay together adjust the Energy Slider up and repeat.

## Finding the Right Settings

Several different factors can influence the way the welder will behave for any given combination of settings (i.e. types of metal being used, thickness of metal, geometry of the workpieces, gaps between mating surfaces, electrode size and shape, gauge of ground wire, argon coverage, etc.). For these reasons, it can be important to experiment and get to know the proper settings for your specific applications.

To fine tune the results and maximize weld quality, it can be extremely helpful to make use of the many configurations the Sunstone PA250i has to offer. Although it can be intimidating to experiment with new technology, "playing" with weld parameters on the Sunstone PA250i can be a fun, educational experience, and can lead to a better understanding of welding varied applications.

## TIPS

- Try the Classic waveform first as it is usually the easiest to adjust for ideal results. Some metals will weld better using Triangle waveform or Square waveform. Try all three to see the differences.
- Always start low in energy and increase until the welds are strong enough and look good.
- In Triangle and Square modes, try setting the Length shorter or longer while keeping the power the same.
- Compare the results.
- Start with no agitation at first, then add it to see the changes in the results. Compare spot sizes and weld quality for each agitation setting.
- Start with the Standard+ ignition profile but try out the other profiles as well to find out which one suits your techniques and application best.

## "Aiming" the Electrode

Electrode placement in relation to the workpiece prior to the weld can have a large influence on weld quality and behavior. Knowing the correct angle of approach and the correct place to touch the electrode can lead to more consistent weld results and weld quality. See Electrode Placement Examples below.

## TIPS

- Aiming the electrode perpendicular to the surface will deliver the most uniform weld spots and the best smoothing.
- The molten metal can sometimes be "pushed" by aiming the electrode at a steeper angle (other than perpendicular). Some metals (like silver) flow better than other metals when being welded and care must be taken not to "dig holes".
- When adding fill material, the heat of the weld can draw the metal toward the electrode. Holding the fill wire too close to the electrode can cause it to stick.
- The weld arc typically originates at the tip of the electrode, but if the shaft of the electrode is close to an edge of the workpiece, arcing can occur in unintended areas and cause the electrode to stick.

### Electrode Placement Examples



*Perpendicular*



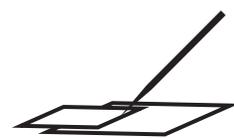
*Corner*



*Fill Wire*

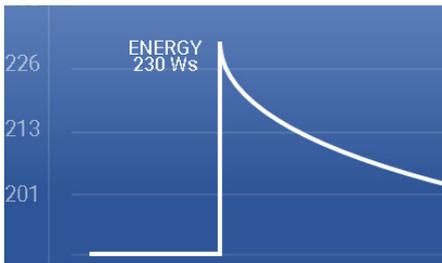


*Edge*

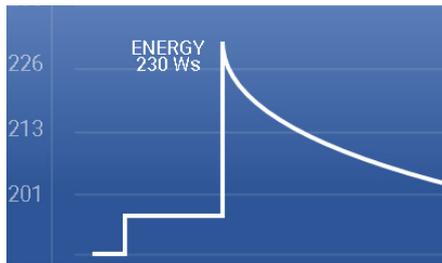


*Overlap/Through*

## Ignition Profiles



Ignition: None

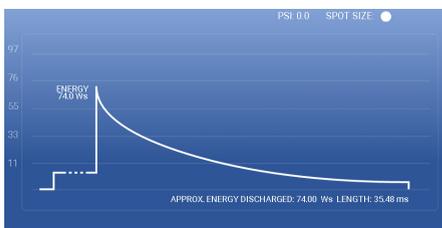


Ignition: Standard +

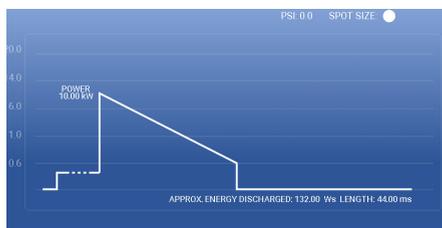


Ignition: Adaptive

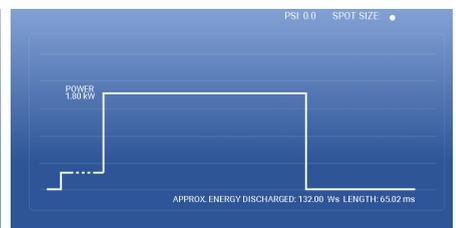
## Weld Discharge Waveforms



Classic Waveform



Triangle Waveform



Square Waveform

## Reading the Waveform Graph

The waveform graph is a helpful tool for understanding what is taking place during a weld. One quick look can provide information such as which ignition mode is being used, which waveform has been selected, which agitation profile is being used, and the length of the energy discharged. The resulting “area under the curve” represents the total energy being discharged and doesn’t include the ignition bump and agitation. See page 18 for more information on waveform graphs.

## IGNITION

During the time right before the main energy discharge of the weld, a low current “Focus Arc” will be displayed for “Standard+” and “Adaptive” ignition modes.

## WELD DISCHARGE WAVEFORM

The shape of the waveform indicates the way the energy is being discharged.

- **Classic Mode** has a high peak current which drops more quickly than the other two waveforms, leading to a smooth weld puddle. The higher the peak, the longer the weld discharge will last (as long as the length is set to 100%). Welds performed with higher peaks are more forceful and produce larger weld spots with more penetration than welds with lower peaks.
- **Triangle Mode** is very similar to Classic, but the discharge is linear and the length can be adjusted independent from the peak (a very high peak can be combined with very short length, or a very short peak can be combined with very long length) . As a result, you can better tailor the way energy is released to suit your needs.

- **Square Mode** can also be adjusted independently, but the peak remains constant for the duration of the discharge. This means that twice the energy would be released into the weld site compared to Triangle mode if the peak and lengths were set to the same values.

## AGITATION PROFILES

If agitation is enabled, the spikes will be displayed on the graph accordingly. Each spike adds to the total energy being discharged. This generally leads to increased penetration, heat, and spot size. Agitation can also improve weld quality in certain metals like stainless steel. Negative agitation takes energy away from the total amount of energy.

### Length

The length of the weld discharge is a large part of how much energy is released into the weld site. The longer the length, the more energy/heat goes into the weld site, especially in Triangle and Square modes. In Classic mode, a longer length results in smooth weld puddles, as the longer the weld lasts the rate of energy discharge decreases, allowing for a gradual drop in temperature.

### Energy

The total area under the graphed line (shown in red in the waveform below for clarity) represents the amount of energy being released into the weld. Generally speaking, the larger the area, the more heat, the larger the spot size, and the more penetration.



## DECLARATION OF CONFORMITY

### Manufacturer Information

Name Sunstone Engineering LLC  
Address 1693 American Way Ste 5  
Payson UT 84651 USA  
Telephone +1 801 658 0015  
Fax +1 866 701 1209

### Product Information

Name Omega PA250i  
Description Multi-mode, pulse welding unit, capable of welding as a resistance and pulsed arc welder  
Model Number Omega PA250i

### Conformity Information

This product conforms to the following directives:

<b>Directive</b>	<b>Document Number</b>	<b>Description</b>
Electromagnetic Compatibility (EMC)	2014/20/EU	Council Directive 2014/30/EU (February 26, 2014) on Electromagnetic Compatibility
Low Voltage Directive (LVD)	2014/35/EU	Council Directive 2014/35/EU (February 26, 2014) Low Voltage Equipment Safety

This product conforms to the following harmonized standards:

<b>Standard</b>	<b>Document Number</b>	<b>Description</b>
EMC Immunity Standard	EN 61000-6-1-2007	Immunity for residential, commercial, and light industrial environments
LVD Standard	EN 60974-6-2016	Arc Welding Equipment - Safety Requirements

**The Technical File required by both directives above is maintained at the headquarters of Sunstone Engineering LLC, 1693 American Way Ste 5, Payson Utah 84651 USA. CE Year 2020**

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1693 American Way Ste 5 • Payson UT 84651 USA

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