Двухимпульсные аппараты точечной сварки CD DP

CDDP

Users Guide

Capacitive Discharge Dual Pulse Welder

For Models 200Ws, 400Ws, 600Ws, 1000Ws, 1100Ws

Table of Contents

Chapter 1: Overview 1
Features 1
Applications 2
What is Capacitive Discharge Resistance Welding 2
Tips 3

Chapter 2: Setup 5
Pre Setup Information 5
Welder Setup 6
Weld Head Setup 7
Hand Held Attachment Setup 7
Roll Spot Setup 8

Chapter 3: How to Operate the Sunstone CDDP 10
How to Use Pulse Controls 11
How to Adjust Energy 12
LCD Screen Messages 12

Welder Specifications 13

Chapter 1: Overview

Features

Sunstone spot welders are simple to use with an intuitive and user-friendly interface. Each of the dual pulse, capacitive discharge welders can be adjusted and fine-tuned to match the requirements of countless applications. When combined with Sunstone's line of weld heads or hand attachments, dual pulse, capacitive discharge welders, such as the Sunstone CDDP, perform strong and repeatable welds for high levels of consistency and quality control.

The Sunstone CDDP welders include the following general features and benefits:

- Removes surface inconsistencies and contaminants
- Available with 200, 400, 600, 1000 Ws, and 1100 Ws of energy
- Single or dual pulse operation
- Microprocessor controlled.
- Thermal protection circuit for internal monitoring
- Audible 'Ready' notification
- Adjustable pulse width
- Energy storage adjustable from 9% to 100% capacity
- Up to 600 welds per minute
- 110/220VAC switching power supply
- Simple, user-friendly interface
- Quick energy release for highly conductive metals
- Small heat effected weld zones
- Repeatable energy release independent of line voltage fluctuations
- Extremely fine energy adjustment
- Infinitely adjustable pulse width

Applications

Capacitive Discharge (CD) resistance welders have many advantages over other welder types. Operators achieve quick energy release for welding highly conductive metals. The quick energy release is concentrated into a small area, which means more delicate projects, such as welding a battery, will maintain the integrity of the cell's chemistry when using Sunstone's dual pulse CD spot welding technology.

Typically, the Sunstone CDDP welder is a suitable solution for the following types of applications:

- Battery pack welding
- Honeycomb welding
- Aerospace welding
- Automotive welding
- Cross wire welding
- Thermocouple welding
- Electronic component welding
- Copper, aluminum, brass, and steel thin sheet and wire welding
- Miscellaneous resistive welding applications

Whether you are manufacturing battery packs or microscopic assemblies, Sunstone CDDP spot welders are the most effective, precision fine-spot resistance welders on the market.

What is Capacitive Discharge Resistance Welding?

Capacitive discharge resistance welding uses capacitors to store energy for quick release. Capacitive resistance welders, also called capacitive discharge or CD welders, have many advantages over other welder types:

- Quick energy release for welding highly conductive metals
- Small heat effected weld zones
- Repeatable energy release independent of line voltage fluctuations
- Capable of extremely fine energy adjustment

With a CD welder, weld nugget formation takes place during the first few milliseconds of the welding process. A CD welder provides for an extremely fast energy release with large peak currents. More of the energy goes into weld formation and less into heating surrounding material. The heat-affected zone, where rapid heating and cooling have changed the properties of the metal, is localized to a small area around the weld spot.

The quick discharge rate of CD welders also allows electrically and thermally conductive materials to be welded. CD welders deliver repeatable welds even during line voltage fluctuations because weld energy is stored before use.

With energy in a stored state, your Sunstone CDDP welder provides control over how the energy is released. The typical capacitor discharge, as illustrated in Figure 3.1, reflects a classic curve. But with adjustments to your welder's controls, you will be able to control how much energy is released in two pulses. See Chapter 3 on page 10 for more information.

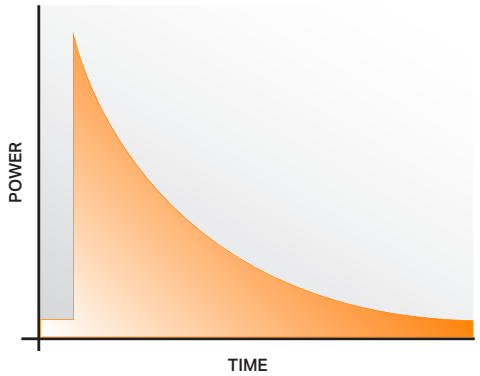


Figure 3.1. Sample capacitor discharge curve.

Weld Formation

Spot welding relies on metal resistivity (resistance) to heat and fuse metal. A large current is passed through the work piece metal. Energy is dissipated due to metal resistance in the form of heat which melts and fuses the weld materials. There are two phases to the melting process. The welder must overcome both the material contact resistance and the bulk resistance of the material.

On the micro-scale, material surfaces are rough and only contact in a limited number of locations, as shown in Figure 3.2. In the first few milliseconds of weld formation, the high-resistance metal bridges melt, allowing other bridges to come into contact to continue the melting process. When all of the bridges have fused, the contact resistance is zero. The bulk resistance of the metal then plays the final role in the weld formation.

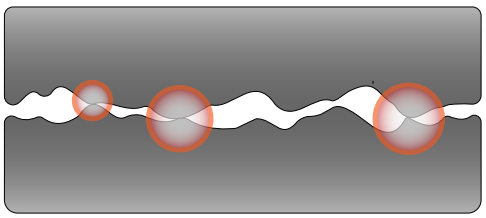


Figure 3.2. Surface roughness limits surface-to-surface contact. More contact points result in a lower contact resistance.

Tips

WELD PRESSURE

Several other factors play a part in the contact resistance. The larger the contact resistance the hotter the resultant weld. On the micro-scale, contact resistance is reduced when more metal bridges or contact points are formed (see Figure 3.2). Using more electrode pressure creates more metal bridges. This results in a lower contact resistance and a cooler weld. Conversely, light electrode pressure results in less metal contact, higher resistance, and a hotter weld. An appropriate amount of pressure should be used to insure good weld strength.

ELECTRODE CONFIGURATIONS

Figure 3.3 shows several electrode configurations used in resistance welding. Figure 3.3a is called a direct weld. Current is passed from one electrode through both work pieces and

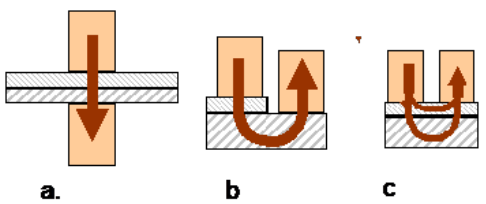


Figure 3.3. Examples of resistance welding electrode configurations. **A***: Direct.* **B***: Step.* **C***: Series.*

out an opposing electrode. Figure 3.3b shows a step electrode configuration. This configuration is used when there is access to only one side of the work piece and an electrode can be placed on both materials. Figure 3.3c is a series configuration. Electrodes can only be placed on one metal surface from one side. Current is divided between the two parts. This weld configuration requires more weld energy.

WELD ENERGY

Sunstone capacitive dual pulse welders allow adjustment of the stored energy via an energy adjustment dial. The energy is then displayed in watt seconds (Ws or Joules) on the front panel of the welder. See Figure 4.1

Figure 4.1. The amount of energy to be released by the welder is displayed here in Ws (or Joules).

Chapter 2: Setup

Pre Setup Information

VOLTAGE AND POWER REQUIREMENTS

Sunstone CDDP welders are equipped with universal power supplies and can be used with both 110/220VAC wall power. No voltage selection is required prior to connecting and powering on the welder. The welder will detect the voltage, and make the appropriate adjustments automatically.

WELD ACTUATION

The CDDP welder is actuated by means of an external trigger port located on the back of the welder (see page 6 for additional setup information). The trigger uses a DIN 3 connector and requires shielded wire. Figure 5.1 shows the proper pin placement for custom external trigger cables. The standard external trigger cable connector is an SD-30LP made by CUI Inc.

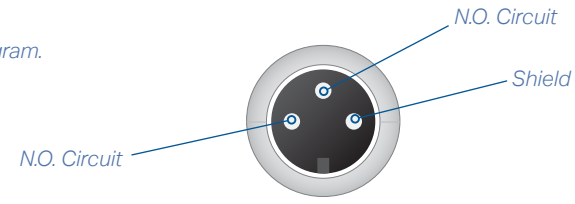
WELDER BEEPS

Sunstone CDDP welders are equipped with a audible alarm (or beep) that, when enabled, will sound when the unit has reached the targeted weld energy. The alarm signifies that the unit is ready to weld. Operators can enable or disable the alarm using a switch located on the back of the welder.

THERMAL PROTECTION

Sunstone capacitive dual pulse welders are equipped with temperature sensors. If the unit is close to overheating, the operator will hear six successive beeps and will not be able to weld during this time. When the unit has cooled, the operator will hear three successive beeps, signifying that the unit is again ready to weld.

Figure 5.1. External trigger wiring diagram. N.O. means "Normally Open."



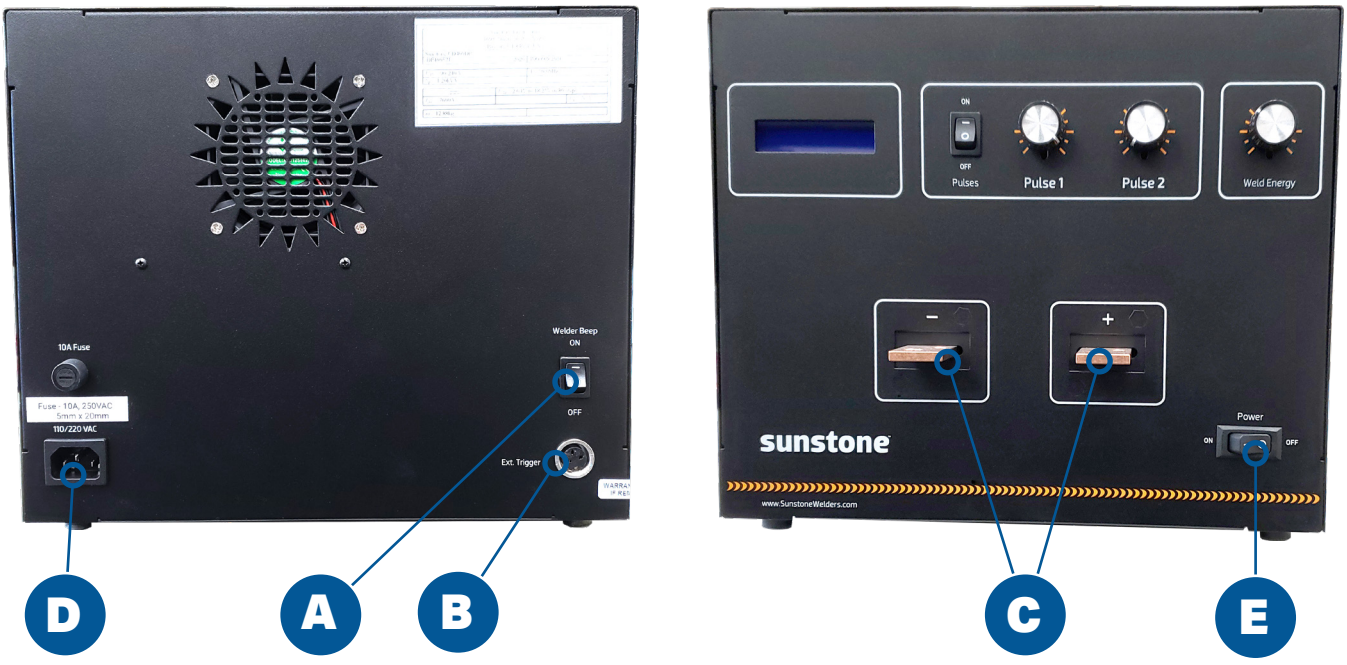
Note: The audible alarm (beeps) for overheating will still occur even if the "Welder Beeps" option is turned off.

To ensure proper cooling, please maintain a clear space of six or more inches around the welder vents.

Welder Setup

- Remove the welder from the box and place it on a secure work surface. Make sure the work space is free of flammable or combustible materials. Make sure the welder has room for proper cooling ventilation.
- Turn the audible alarm (beep) on or off according to user preference by flipping the switch (A) on the welder's back panel. See Figure 6.1.
- Connect the external trigger (the component that will trigger the weld, usually a foot pedal) into the Ext. Trigger port (B) found on the back of the welder.
- You can connect hand attachments or a weld head to the CDDP. Attach the cables to the negative and positive terminals (C) found on the front of the welder. If you plan to use a weld head, see the next section, "Weld Head Setup," for additional information. If you plan to use a hand attachment, see "Hand-held Attachment Setup" on page 7. If you plan to use a roll spot, see "Roll Spot Setup" on page 8.
- Connect the power cord into the back of the welder and into an AC power outlet (D).
- Turn the welder on by flipping the power switch (E) on the front of the welder.

Figure 6.1. Back and Front panels of the Sunstone CDDP welder.



Weld Head Setup

Sunstone manufactures a variety of weld heads to accommodate a diverse range of welding applications, as shown in Figure 7.1. Both the parallel and opposed Sunstone weld head provides a great amount of control and precision. Follow these abbreviated instructions to connect a weld head to the CDDP.

- Remove the weld head from the box and place it on a secure work surface.
- Attach the weld head cables to the negative and positive terminals (see (C) in Figure 6.1).
- For operating the weld head manually, see the weld head users guide for setup.
- For operating the weld head pneumatically, see the weld head users guide for setup.
- Turn the welder on, assure the weld head is actuating, then set the desired energy setting. See Chapter 3 on how to select desired energy settings.

Note: See weld head user manual for more precise setup information.

Figure 7.1. Weld head connected to the CDDP welder.

Hand Held Attachment Setup

Sunstone Engineering manufactures a variety of welding hand pieces to accommodate a diverse range of welding applications. Hand piece welding attachments allow ease of use and versatility. Follow these instructions to connect a hand held attachment to the Sunstone CDDP:

- Remove the hand held attachment from its package.
- For Single Probe, Dual Probe (see Figure 7.2), and Tweezer hand held attachments, connect the attachment cables to the negative and positive terminals (see (C) in Figure 6.1) on the front of the welder, then connect the 3 pin actuation foot pedal cable to the Ext. Trigger port (see B in Figure 6.1) on the back of the welder.
- For Pressure Actuated hand attachments (see Figure 7.3), connect the attachment cable to either of the terminals on the front of the welder and the grounding

Figure 7.2. Dual Probe hand held attachment example.

Figure 7.3. Pressure Actuated hand held attachment sample.

Figure 8.1. Roll Spot hand held attachment example. This configuration requires an upgrade.

Figure 8.2. When using a Roll Spot hand held attachment, be sure the Pulse setting is on.

clip cable to the other terminal. Then connect the trigger cable to the Ext. Trigger port (see (B) in Figure 6.1) on the back of the welder.

- Turn the welder on and set the desired energy settings. See Chapter 3 on how to select desired energy settings.

Roll Spot Setup

The Sunstone CDDP can be upgraded to accept a roll spot attachment (see Figure 8.1). With a roll spot, the operator can perform a continuous string of welds for any prolonged time period, for as long as the trigger signal is held. The roll spot function requires a special hand piece that is designed specifically for roll spot welding. Follow these instructions to connect the roll spot attachment to the CDDP:

- Remove the roll spot attachment from its package.
- Connect the roll spot cable to either of the terminals on the front of the welder (see C in Figure 6.1) and the grounding clip cable to the other terminal. Then attach the trigger cable to the Ext. Trigger port on the back of the welder (see B in Figure 6.1).
- Plug the welder power cable into an AC power outlet.
- Turn the welder on and set the desired energy settings. See Chapter 3 on how to select desired energy settings.
- Make sure the Pulse Switch is on. See Figure 8.2. The roll spot function alters the trigger and timing configurations of the welder. See details below.
    - The normal Pulse On/Off switch found on the front of the welder, which normally would turn the weld function on/off, is re-purposed to switch between Single Fire (SF) and Roll Spot (RS) modes; thus, the welds cannot ever be turned off while the welder is still on. **Thus, when the Pulse Switch is off, the welder is in single fire mode; when the Pulse Switch is on the welder is ready for roll spot functionality.**

- **Important:** The system will NOT turn welds off while in RS mode. If the welder is turned on, the welder is active and will weld if a trigger signal is sent to the welder.
- In SF mode, the unit will weld once per trigger signal.
- While in SF mode, all dials and interface options (aside from the pulse on/off switch) will operate the same as on the standard, non-upgraded, base model welder.
- In RS mode, however, the device will continuously weld at an adjustable rate for as long as the trigger signal is maintained. If using a foot pedal, the welder will continue to weld for as long as the foot pedal is depressed. If using a pressure actuated hand piece, the welder will continue to weld for as long as the pressure actuated switch is engaged.
- In RS mode, the system has an adjustable "between-weld" delay that affects the frequency or rate of welding while a trigger signal is maintained.
- In RS mode, two variables will affect the time between each weld. The first is an adjustable minimum weld delay that can be set by the operator. This is accomplished by turning the "Pulse 1" dial on the front of the welder. The second factor is the recharge time between welds. This is determined based on the energy setting. The higher the weld energy, the longer the delay between welds will be.
- In RS mode, the "Pulse 2" dial is used to select the total weld time of each individual weld that takes place during the RS welding process.
- Summarily, Pulse 1 controls the minimum weld delay between welds. Pulse 2 controls the weld time, or pulse width, of every weld. The Weld Energy knob controls peak weld energy. **Note: Higher energy will require longer recharge times between wels.**
- The distance between welds is based on the welding rate and the electrode travel speed moving across the work piece. To place welds closer together, decrease the weld time or slow the elctrode travel time. To increase the space between welds, increase the weld time or quicken the electrode travel time.

Chapter 3: How to Operate the Sunstone CDDP

Assuming you have read all safety notices, have a clear work area, and have already connected a weld head or hand held attachment to the CDDP, refer to Figure 10.1 and follow these instructions to release energy and actuate a weld:

Figure 10.1. To operate the Sunstone CDDP:

1. *Turn on the welder using the Power Switch (A).*
2. *Make sure the Pulses Switch (E) is on.*
3. *Set the weld energy by turning the Weld Energy knob (D).*
4. *Next, set the turn the Pulse 1 adjustment knob (B) to set power for Pulse 1 and then the Pulse 2 adjustment knob (C) for Pulse 2.*
5. *Actuate the trigger to send energy to the electrode(s).*

- Power on the CDDP using the Power Switch (A) in the bottom right-hand corner of the welder's front panel. The LCD screen on the front of the welder will illuminate and display the message POWER ON.
- Make sure the Pulse Switch (E) is turned to the ON position if you wish to actuate a weld. If you are using a Roll Spot hand held attachment, see Roll Spot Setup on page 8.
- Select the desired weld energy by turning the Weld Energy adjustment knob (D). The LCD screen will display the energy level as you turn the knob. Sunstone manufactures five different CDDP models based on the total amount of energy they are able to deliver: 200 Ws, 400 Ws, 600 Ws, 1000 Ws, and 1100 Ws. V
- The CDDP has two pulse width energy controls. The LCD screen displays each pulses' total stored energy as a percentage of the total stored energy in Joules (J). Each pulse can be adjusted separately or turned off, if desired, using the Pulse Switch (B). Both pulses can be turned off without adjusting pulse values to facilitate weld attachment setup or electrode maintenance. Pulse 1 is adjustable between 1% and approximately 30% of the total weld energy. Pulse 2 is adjustable between

1% and 99% of the total weld energy. **Please note that when used in dual pulse mode, the Pulse 2 energy level represents the percent of remaining power. For example if Pulse 1 was set to 25%, the Pulse 2 setting would actually be taken from the remaining 75% of the total weld energy.** See page 12 for more information on energy adjustments.

- Set the power for Pulse 1. Turn the Pulse 1 adjustment knob (B) to select the desired energy setting as percentage of the total stored energy. The LCD screen will display the percentage.
- Set the power for Pulse 2 by turning the Pulse 2 adjustment knob (C) to select the desired energy setting as a percentage of the total stored energy. The LCD screen will display the percentage.
- Make sure the work piece is ready for welding and the workspace is clear.
- Place the hand held attachment's electrode(s) where you wish to place the weld and depress or activate the trigger. The welder will release energy accordingly. If using a weld head, see the weld head users guide for how to actuate the weld.

How to Adjust Energy

Each Sunstone welder is fully adjustable between its minimum and maximum energy. Sunstone capacitive dual pulse welders have weld repetition rates of up to 600 welds/min. See table on page 14 for additional details on weld repetition rates.

The Weld Energy knob (D) is used to set the total welder energy storage and is also used to set the peak weld current. The pulse widths are then adjusted to provide the appropriate weld energy released during each weld.

How to Use Pulse Controls

Sunstone dual pulse welders have two pulse width energy controls. In dual pulse mode Sunstone welders will fire twice from a single actuation. See Figure 11.1. The first pulse is used to remove surface inconsistencies and contaminants which

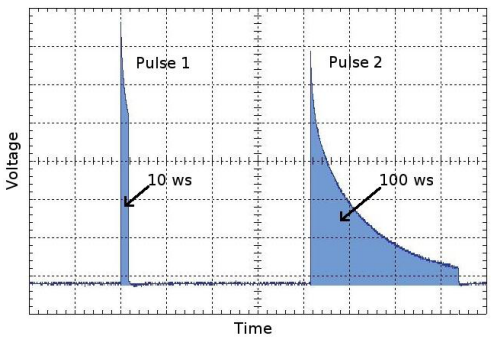


Figure 11.1 Graphical representation of a weld with dual pulses of energy.

helps to displace oils, break through oxide layers, and seat the welding electrodes. As mentioned earlier, Pulse 1 is adjustable between 1% and approximately 30% of the total stored energy. Pulse 2 is adjustable between 1% and 99% of the stored energy.

Note: When used in dual pulse mode the Pulse 2 energy level represents the percent of remaining power. For example, if Pulse 1 was set to 25%, the Pulse 2 setting would actually be taken from the remaining 75% of the set-point energy. The energy of Pulse 1 and 2 combined cannot be greater than the total weld energy.

SETTING PULSE 1 AND 2

The Pulse 1 energy setting should be chosen such that the parts adhere weakly. To determine Pulse 1, turn off Pulse 2 and do a series of test welds starting at a low pulse energy setting. Increase the pulse energy about 3% every test until the parts stick together to achieve maximum heat. Pulse 1 energy is typically below 10%. Pulse 2 energy is typically between 50% and 70%.

A test weld should be performed and pulled apart to determine weld strength. A nickel strip to nickel plated steel weld, typically seen in battery pack manufacturing, should pull apart leaving holes in the thin nickel metal and leaving the weld nuggets on the battery terminal. Thicker materials should be pulled with a specific pull force requirement in mind.

LCD Screen Messages

Messages are shown on the LCD display to indicated that a change is being made to the welder. Here is a list of messages and what they indicate:

POWER ON. This message is displayed when the welder has been turned on.

READY. This message is displayed after you weld and the unit is ready to weld again.

BEEP ON/OFF. Displays when you toggle the “Beep Enabled” switch. You will hear audible beeps when on.

WELD ON/OFF. Displays when you toggle the “Pulses” switch. The welder will not weld with this switch off.

P1 ON/OFF. Displays when pulse 1 has been switched off or on.

P2 ON/OFF. Displays when pulse 2 has been switched off or on.

NO PULSE. Indicates that both pulses have been turned off. At least one pulse has to be on in order to weld.

NEW P1/P2. Displays when either pulse 1 or pulse 2 is adjusted.

Cooling/Enabled. Should the CDDP overheat, it will display “COOLING” until it has reached an operable temperature. Then the welder will display “ENABLED” to let you know that it is done cooling.

CDDP Welder Data

	CD200DP	CD400DP	CD600DP	CD1000DP	CD1100DP
Footprint (HXWXD)	26.7X30.5X34.3 cm 10.5X12X13.5 in.	26.7X30.5X34.3 cm 10.5X12X13.5 in.	26.7X30.5X34.3 cm 10.5X12X13.5 in.	28X47.6X35.6 cm 11X18.75X14 in.	28X47.6X35.6 cm 11X18.75X14 in.
Weight	34 lbs./16kg	39 lbs./18kg	39 lbs./18kg	55 lbs./26kg	56 lbs./26kg
Input Voltage	85 - 260 VAC	85 - 260 VAC	85 - 260 VAC	85 - 260 VAC	85 - 260 VAC
Frequency Range	47-63Hz	47-63Hz	47-63Hz	47-63Hz	47-63Hz
Power Factor (typ.)	PF>0.94/230VAC PF>0.99/115VAC	PF>0.94/230VAC PF>0.99/115VAC	PF>0.94/230VAC PF>0.99/115VAC	PF>0.94/230VAC PF>0.99/115VAC	PF>0.94/230VAC PF>0.99/115VAC
AC Current (typ.)	8.5A/115VAC 5A/230VAC	8.5A/115VAC 5A/230VAC	8.5A/115VAC 5A/230VAC	8.5A/115VAC 5A/230VAC	8.5A/115VAC 5A/230VAC
Min/Max Output	5 Ws - 200 Ws	5 Ws - 400 Ws	5 Ws - 600 Ws	5 Ws - 1000 Ws	5 Ws - 1100 Ws
Pulse Width	0.53 - 43.2 ms	0.37 - 48.1 ms	0.29 - 51.1 ms	0.23 - 54.7 ms	0.23 - 55.4 ms
Rise Time (to Max Voltage)	0.2 ms	0.2 ms	0.2 ms	0.2 ms	0.2 ms
Min Pulse Height	2.5 V	2.04 V	2.04 V	2.2 V	2.2 V
Max Pulse Height	15.8 V	18.3 V	22.4 V	20.5 V	21.5 V
Peak Current for 1 AWG 4'	7905	9130	11180	10250	10750
Peak Current for 4 AWG 6'	6081	7023	8600	7885	8269
Peak Current for 8 AWG 6'	3162	3652	4472	4100	4300

Weld Speeds (welds per minute) **with PG2 Copper Wheel or Weld Head (1 AWG @ 1.8 mΩ)**				
WS	**CD200DP**	**CD400DP**	**CD1000DP**	**CD1100DP**
10	185	167	149	149
20	150	135	125	125
40	118	105	96	96
100	84	73	68	68
200	62	54	51	51
400	-	38	36	36
600	-	-	29	29

Weld Speeds (welds per minute) **with DPHP-MP (4 AWG @ 4.2 mΩ)**				
WS	**CD200DP**	**CD400DP**	**CD1000DP**	**CD1100DP**
10	188	182	164	164
20	158	145	134	134
40	122	111	102	102
100	88	76	71	71
200	66	56	51	51
400	-	39	36	36
600	-	-	30	30

Weld Speeds (welds per minute) **with DPHP-LP (8 AWG @ 8.8 mΩ)**				
WS	**CD200DP**	**CD400DP**	**CD1000DP**	**CD1100DP**
10	215	196	177	177
20	177	170	148	148
40	132	121	117	117
100	93	81	76	76
200	69	60	56	56
400	-	30	39	39
600	-	-	30	30

The best welder chooses the best welders.

The Sunstone line of advanced dual pulse CD welders places absolute digital energy control in your hands. Available in four different power models, from the cheeky 200, 400, and 600 Ws models to the beefy 1200 Ws behemoth. PLC-ready and perfect for any production floor. Only the very best for the very best!

Алматы (7273)495-231
Ангарск (3955)60-70-56
Архангельск (8182)63-90-72
Астрахань (8512)99-46-04
Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Благовещенск (4162)22-76-07
Брянск (4832)59-03-52
Владивосток (423)249-28-31
Владикавказ (8672)28-90-48
Владимир (4922) 49-43-18
Волгоград (844)278-03-48
Вологда (8172)26-41-59
Воронеж (473)204-51-73
Екатеринбург (343)384-55-89
Ижевск (3412)26-03-58
Иваново (4932)77-34-06
Иркутск (395)279-98-46
Казань (843)206-01-48
Калининград (4012)72-03-81
Калуга (4842)92-23-67
Кемерово (3842)65-04-62
Киров (8332)68-02-04
Коломна (4966)23-41-49
Кострома (4942)77-07-48
Краснодар (861)203-40-90
Красноярск (391)204-63-61
Курск (4712)77-13-04
Курган (3522)50-90-47
Липецк (4742)52-20-81
Магнитогорск (3519)55-03-13
Москва (495)268-04-70
Мурманск (8152)59-64-93
Набережные Челны (8552)20-53-41
Нижний Новгород (831)429-08-12
Новокузнецк (3843)20-46-81
Ноябрьск (3496)41-32-12
Новосибирск (383)227-86-73
Ноябрьск (3496)41-32-12
Омск (3812)21-46-40
Орел (4862)44-53-42
Оренбург (3532)37-68-04
Пенза (8412)22-31-16
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Симферополь (3652)67-13-56
Смоленск (4812)29-41-54
Сочи (862)225-72-31
Ставрополь (8652)20-65-13
Сыктывкар (8212)25-95-17
Сургут (3462)77-98-35
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