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CD DPM2 Welder

User Manual

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A PRODUCT OF SUNSTONE ENGINEERING

CD160 DPM2/CD320 DPM2/CD630 DPM2/CD1000 DPM2

CD DPM2 Welders

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NOTE: The information contained in this manual is subject to change as improvements are made to our products. Visit www.SunstoneSpotWelders.com for the latest version of this document.

At Sunstone we are committed to producing quality products and ensuring complete owner satisfaction. If you require assistance after reading this manual please contact us with the information provided below.

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Safety Procedures and Precautions

- **Never** open welder to perform any maintenance operation inside the unit.
- Wear appropriate eye protection at all times while using the welder.
- Care should be taken not to short across the positive and negative terminals. At full power, the weld current is many thousands of amps and is dangerous if the terminals are accidentally bridged.
- Do not wear metal jewelry when welding. The terminals are safe to touch without fear of arcing as long as no metal is on your hands.
- Welding cables can become extremely hot. After extended use, be cautious when removing the weld cables.
- When altering any part of the welding path (such as swapping electrodes or cables), turn the unit off or enter the menu to ensure no accidental triggering of a weld occurs.
- Be careful not to pinch fingers in moving weld head parts or between welding electrodes.
- Avoid touching weld spots immediately after the weld has been performed as they will be hot.
- All welds are performed at low voltage for increased safety of operation.

Principal Safety Standards

Safety in Welding, Cutting, and Allied Processes, [ANSI Standard Z49.1](#), from [Global Engineering Documents](#) (phone: 1-877-413-5184, [website:www.global.ih.com](http://www.global.ih.com)).

OSHA, Occupational Safety and Health Standards for General Industry, Title 29, Code of Federal Regulations (CFR), Part 1910, Subpart Q, and Part 1926, Subpart J, from U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 5250-7954
(phone: 1-866-512-1800) (there are 10 Regional Offices—phone for Region 5, Chicago, is 312-353-2220, [website: www.osha.gov](http://www.osha.gov)).

National Electrical Code, [NFPA Standard 70](#), from [National Fire Protection Association](#), P.O. Box 9101, Quincy, MA 02269-9101 (phone: 617-770-3000, [website: www.nfpa.org](http://www.nfpa.org) and www.sparky.org).

Canadian Electrical Code Part 1, [CSA Standard C22.1](#), from [Canadian Standards Association](#), Standards Sales, 5060 Mississauga, Ontario, Canada L4W 5N5 (phone: 800-463-6727 or in Toronto 416-747-4044, [website: www.csa-international.org](http://www.csa-international.org)).

Safe Practice For Occupational And Educational Eye And Face Protection, [ANSI Standard Z87.1](#), from [American National Standards Institute](#), 25 West 43rd Street, New York, NY 10036-8002 (phone: 212-642-4900, [website:](http://www.ansi.org)

The DPM2 Welder

FEATURES

- Dual Pulse operation removes surface inconsistencies and contaminants.
- Single or dual Pulse operation.
- Microprocessor Controlled.
- Thermal Protection Circuit.
- Audible 'Ready' Notification.
- Adjustable pulse width.
- Available in 160ws, 320ws, 630ws, and 1000ws.
- Energy storage adjustable from 9% to 100% capacity.
- Up to 240 welds/min.
- 110/220VAC Switching Power Supply.
- Simple, user-friendly interface.
- Quick energy release for welding highly conductive metals such as copper.
- Small heat effected weld zones.
- Repeatable energy release independent of line voltage fluctuations.
- Capable of extremely fine energy adjustment.

Chapter 1: Fundamentals of Capacitive Discharge Resistance Welding.

Capacitive discharge resistance welding uses capacitors to store energy for quick release. Figure 1: shows a typical capacitor discharge curve.

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 such as copper.
- Small heat effected weld zones.
- Repeatable energy release independent of line voltage fluctuations.
- Capable of extremely fine energy adjustment.

Weld nugget formation takes place during the first few milli-seconds of the welding process. A CD welder allows 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 the properties of the metal have been changed by rapid heating and cooling, is localized to a small area around the weld spot. The quick discharge rate of CD welders also allows electrically and thermally conductive materials,

such as copper or aluminum, to be welded. Capacitive welders deliver repeatable welds even during line voltage fluctuations because weld energy is stored before use.

WELD FORMATION

Spot welding relies on metal resistivity (resistance) to heat and fuse metal. A large current is passed through the workpiece 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.

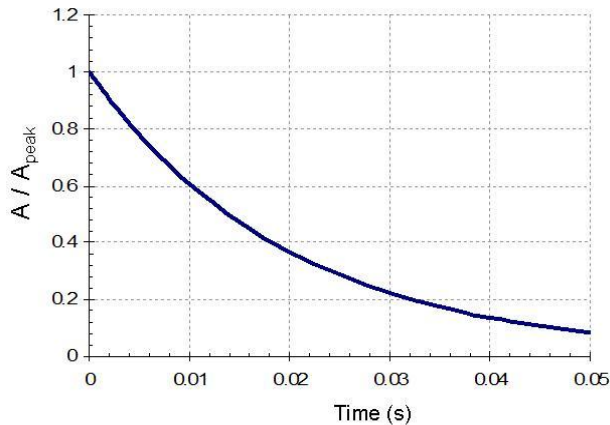


FIGURE 1: Sample Capacitor Discharge Curve.

Figure 2 shows an example of a micro-scale surface profile. On the micro-scale, material surfaces are rough and only contact in a limited number of locations. In the first few milli-seconds 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.

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 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.

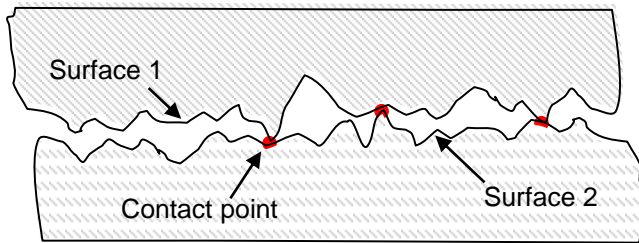


FIGURE 2: On the micro-scale, surface roughness limits surface-to-surface contact. More contact points result in a lower contact resistance.

ELECTRODE CONFIGURATIONS

Figure 3 shows several electrode configurations used in resistance welding. Figure 3a is called a direct weld. Current is passed from one electrode through both workpieces and out an opposing electrode. Figure 3b shows a step electrode configuration. This configuration is used when there is access to only one side of the workpiece and an electrode can be placed on both materials. Figure 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.

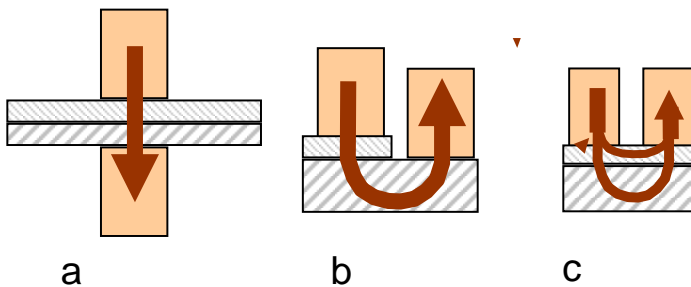


FIGURE 3: Examples of resistance welding electrode configurations: a. direct, b. step, c. series.

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 (Joules) on the front panel.

Chapter 2: Using Sunstone Dual Pulse Welders

BLUE BACK-LIT LCD DISPLAY

Displayed Messages:

Messages are shown on the LCD display to indicate that a change is being made to the welder. Here are 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 – Shows up when you toggle the “Beep Enabled” switch. You will hear audible beeps when on.

Weld On/Off – Shows up when you toggle the “Pulses” switch. The welder will not weld with this switch off.

P1 On/Off – Will be displayed when pulse 1 has been switched off or on.

P2 On/Off – Will be displayed when pulse 2 has been switched off or on.

No Pulse – This indicates that both pulses have been turned off. At least one pulse has to be on in order to weld.

NEW P1/P2 – This message will display when either pulse 1 or pulse 2 is adjusted.

Cooling/Enabled – When the unit overheats, 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.

WELD ENERGY INDICATION:

Figure 4: shows the Sunstone Engineering Dual Pulse CD welder front panel. Weld energy (joules, watt*seconds) is indicated with a blue back-lit LCD display.



FIGURE 4: Welder front panel features: Blue LCD energy indication display with easy to use pulse width and energy control interface, each pulse can be turned off individually and both can be turned off at the same time for weld attachment setup, large weld head hook-up cables for 1/4" and 5/16" studs, on/off switch.

PULSE CONTROL:

Sunstone Dual Pulse welders have two pulse width energy controls. The blue back-lit LCD displays each pulses' percent of total stored energy and the total stored energy in Joules (J). Each pulse can be adjusted separately or turned off if desired. 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 stored energy. Pulse 2 is adjustable between 1% and 99% of the stored 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 set-point energy.



FIGURE 5: Welder back panel: External trigger port, 20A fuse, Beep enable, and 110/220 VAC voltage input

.WELDER BEEPS

Sunstone capacitive Dual Pulse welders are equipped with a beeper. When enabled, the welder will beep when the unit has reached its targeted weld energy. This signifies that the unit is ready to weld.

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. To ensure proper cooling, the welder flow paths shown in Figure 6 should be unobstructed. Please maintain a clear space of 6+ inches around the welder vents.

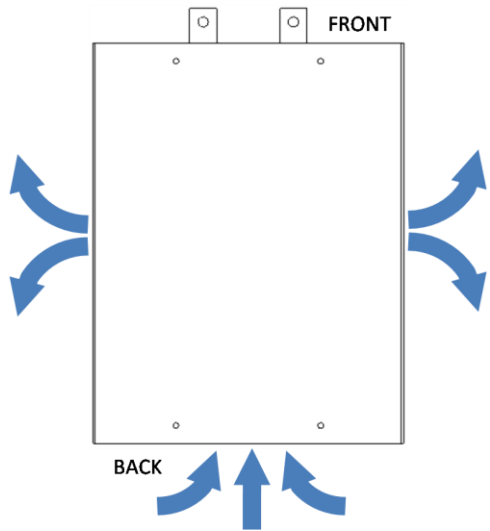


FIGURE 6: For proper cooling, ensure all vent locations are unobstructed.

ENERGY ADJUSTMENT

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 3 for additional details on weld repetition rates. The weld energy knob 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.

WELD ACTUATION

The welders are actuated by means of an external trigger port located on the back of the welder (see Figure 7). The trigger uses a DIN 3 connector and requires shielded wire. Figure 7 shows the proper pin placement for custom external trigger cables (shown for welder back panel connector). The standard external trigger cable connector is an SD-30LP made by CUI Inc.

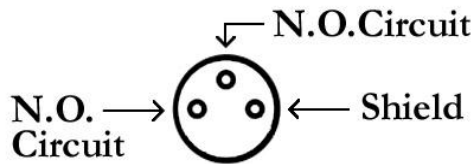


FIGURE 7: External trigger wiring diagram, looking at back of welder, for the welder back panel connector. N.O. stands for Normally Open.

WELD ATTACHMENTS

Sunstone Engineering manufactures a variety of welding hand pieces and Weld Heads to accommodate a diverse range of welding applications. Hand piece welding attachments allow ease of use and versatility, while fixed Weld Heads provide control and precision. Cabling between welder and Weld Head is important in determining peak weld current and adjusting weld pulse timing. Table 1 indicates peak currents that can be expected with 3 to 4 foot sections of these cables. Typically, hand pieces will use 4 to 8 AWG wire while Weld Heads will be hooked up with 0 or 4 AWG wire.

VOLTAGE AND POWER REQUIREMENTS

Sunstone capacitive Dual Pulse welders are equipped with universal power supplies and can be used with both 110/220V AC 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.

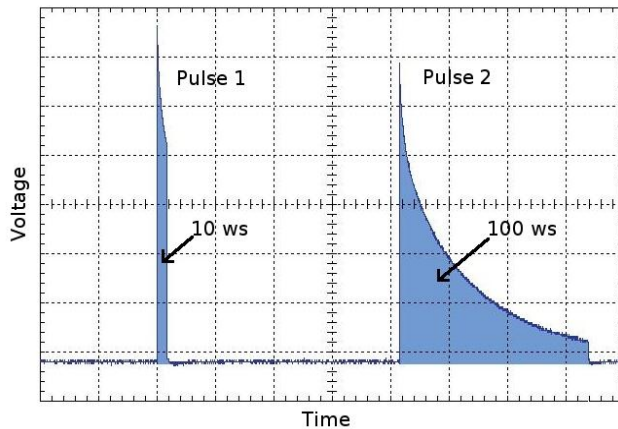


FIGURE 8: Capacitor discharge using the dual pulse setting.

USING THE DUAL PULSE WELD FUNCTION

Using multiple current pulses increases weld quality. In dual pulse mode Sunstone welders will fire twice from a single actuation. The first pulse is used to remove surface inconsistencies and contaminants. This initial burst of energy displaces oils and breaks through oxide layers.

The pulse also seats the welding electrodes. The second pulse is done at a much higher energy level (watt*seconds) and performs the actual weld. Figure 8 shows what the welder discharge curve would look like when using the dual pulse setting as outlined above.

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.

TABLES

Quick-reference Tables 1 – 5 provide useful information for using Sunstone Dual Pulse welders.

For additional information and instructional videos, please visit our web page: www.SunstoneSpotWelders.com.

TABLE 1: Peak weld current shown by model number and external cabling gauge number (AWG). Four and eight AWG cabling is typically seen when using hand held attachments. *Minimum Load = 1mOhm, using a smaller load may damage the welder.

Model	1 AWG 1mOhm Load 4 feet	4 AWG 1.6mOhm Load 6 feet	8 AWG 4mOhm Load 6 feet
160	10000	7692	4000
320	10000	7692	4000
630	11150	8577	4460
1000	10250	7885	4100

TABLE 2: Sunstone Dual Pulse general technical specifications.

Feature	CD160DPM2 / CD320DPM2 CD630DPM2 / CD1000DPM2
Dual Pulse	Yes
Pulse 1 Energy Adjustment (% of set-point energy)	1% - 30%
Pulse 2 Energy Adjustment (% of set-point energy)	1%-99%
Peak Current	10,000-11,150 Amps

TABLE 3: Weld speed in welds per minute by Dual Pulse model number at maximum energy set-point.

Pulse width (max energy set-point)	Rep Rate CD160DPM2 welds/min (pulse energy)	Rep Rate CD320DPM2 welds/min (pulse energy)	Rep Rate CD630DPM2 welds/min (pulse energy)	Rep Rate CD1000DPM2 welds/min (pulse energy)
10%	275 (15ws)	240 (30ws)	140 (60ws)	120 (100ws)
25%	200 (38ws)	150 (75ws)	90 (150ws)	76 (250ws)
50%	175 (75ws)	100 (150ws)	55 (300ws)	60 (500ws)
100%	125 (160ws)	60 (320ws)	27 (630ws)	36 (1000ws)

TABLE 4: Weld pulse characteristics.

Model	Min and Max Output	Pulse Width		Rise Time (to max voltage)	Min Pulse Height	Max Pulse Height
		Min	Max			
CD160DPM2	5 ws - 160 ws	Min	0.12ms	0.2 ms	2.2 V	20 V
		Max	6.0ms			
CD320DPM2	5 ws - 320 ws	Min	0.12ms	0.2 ms	2.2 V	20 V
		Max	11.0ms			
CD630DPM2	5 ws - 630 ws	Min	0.12ms	0.2 ms	2.2 V	23 V
		Max	24.0ms			
CD1000DPM2	30 ws - 1000 ws	Min	0.12ms	0.2 ms	3.5 V	20.5 V
		Max	32.0ms			

TABLE 5: Sunstone Dual Pulse welder physical characteristics.

	CD160DPM2		CD320DPM2		CD630DPM2		CD1000DPM2	
	Inches	Cm	Inches	cm	Inches	cm	Inches	cm
Height	10.5	26.7	10.5	26.7	10.5	26.7	11	28.0
Width	12.0	30.5	12.0	30.5	12.0	30.5	18.75	47.6
Depth	13.5	34.3	13.5	34.3	13.5	34.3	14	35.6
Weight	31 lbs	(15 kg)	34 lbs	(16 kg)	39 lbs	(18 kg)	56 lbs	26 (kg)

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