CDDP-A

User Manual

Advanced Capacitive Discharge Dual Pulse Welder
For Models 200Ws, 400Ws, 600Ws, 1200Ws

Version 20220113 • Part #1176

sunstone™
The Micro Welder Experts

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

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ISSUE	DATE	APPROVAL	NOTES
0	2/10/2020	DH	GENERAL FORMATTING AND ORGANIZATION CHANGES; INCLUSION OF PLC AND ETHERNET INFORMATION
1	01/2022	DH	REVISIONS AND ADDITIONS, CABLE SETUP
2			
3			
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Chapter 1: Overview

Features

Sunstone's advanced dual pulse CD welders offer many capabilities including weld monitoring, SPC tools, and a large capacitive touch-screen interface. The touch-screen interface provides easy access to all weld parameters. In addition, you get a visual of the weld waveform graph, weld histograms, alarms, warnings, and even on-screen documents and videos. For automated production settings, the welder has multiple PLC protocols. You can also set up multiple machines in a simplified way thanks to the clone feature. Cloning allows you to copy all your parameters/settings and easily export/import them to other machines.

Capacitive Discharge (CD) resistance welders have many advantages over other welder types. Since CD welders use capacitors to store and release weld energy, your weld energy will be highly repeatable and will not be affected by line voltage fluctuations. You can also achieve quick energy release for welding highly conductive metals such as copper. This quick energy release is concentrated into a small area, generating a small heat signature or heat affected zone.

Sunstone's CDDP-A welders provide the following benefits:

- A very small heat-affected zone during the weld
- Ability to easily position welds exactly where you need them
- The versatility of welding on very small, thin, and delicate metal parts
- A wide range of metals that can be welded
- Dual Pulse operation removes surface inconsistencies and contaminants
- Single or Dual Pulse operation
- Consistency and repeatability
- Very low maintenance on the machine
- Small compact size designed to fit on and around any work area

The key features of the Sunstone CDDP-A are as follows:

- Touch-screen interface
- Microprocessor controlled operation
- Dual pulse
- Weld monitoring of peak currents
- Monitor limits with logic (inhibit second pulse)
- Weld head controls
- Remote schedule select
- Weld counter
- Set current or voltage
- Visual graph of weld waveform
- Statistical process controls
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- Comparator
- Alarms and warnings
- Timestamp data feedback
- Full welder cloning
- Emergency Stop
- Roll-Spot Welding
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- Lock-Out Mode
- PLC Ready
- Import/Export weld data
- Software updates
- Multiple languages
- Save settings
- Wi-Fi connectivity
- On-screen PDFs and videos

What is Capacitive Discharge Resistance Welding?

Capacitive discharge resistance welders, also called capacitive discharge or CD welders, utilize internal capacitors to store energy. These capacitors are able to discharge large amounts of energy very rapidly. The rapid discharge of energy is critical to forming the weld nugget. Formation of the weld nugget occurs during

the first few milliseconds of the welding process. Sunstone's proprietary technology allows the energy to be discharged with very high peak currents, as seen in Figure 3.1 to produce the best weld nuggets.

This technology is not only designed to increase the energy delivered for weld formation but to also minimize the heat that is spread to the surrounding material. This 'heat-affected zone' around the weld can suffer from rapid heating and cooling from the weld. But with Sunstone's proprietary technology, this zone can be localized to just a small spot around the weld.

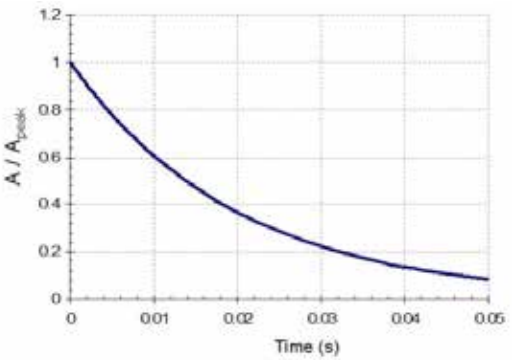


Figure 3.1. Sample capacitor discharge curve with high peak current.

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. The welder must overcome both the contact resistance and the bulk resistance of the material in order to begin the melting process.

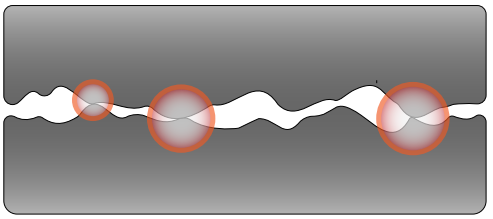


Figure 3.2. On the micro scale, surface roughness limits surface-to-surface contact. More contact points result in lower resistance.

Figure 3.2 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 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.

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, resulting in 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 ensures good weld strength.

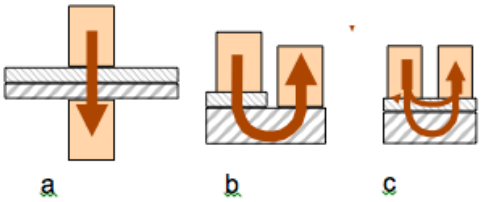


Figure 4.1. Resistance welding electrodes can appear in three different configurations: a) Opposed; b)Step; and c)Series or Parallel.

ELECTRODE CONFIGURATIONS

As shown in Figure 4.1, several electrode configurations can be used in resistance welding:

- **Opposed Configuration.** Current is passed from one electrode through both work pieces and out an opposing electrode.
- **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.
- **Series or Parallel 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 discharge dual pulse welders allow adjustment of the stored energy via the touch screen user interface, shown in FIGURE 4. The energy is then displayed in watt seconds (Joules) as a waveform graph on the user interface LCD display. The Total Stored Energy will change how much energy is stored in the internal capacitors and directly corresponds to the peak current available. The energy of Pulse 1 and Pulse 2 can be changed independent of each other, but the Total Stored Energy of Pulse 1 and Pulse 2 added together must be less than or equal to the Total Stored Energy. More information can be found on page 14 of this manual.

Chapter 2: Setup and Installation

Safety

- Carefully read the Sunstone Safety and Basics booklet that accompanied this welder prior to operation. As the operator of this welder, you assume responsibility for your safety and those around you.
- Carefully read the user guide that accompanied your weld head or hand piece.
- Before pressing the foot pedal and triggering a weld, make sure nothing is obstructing the electrodes, other than the work piece being welded.
- If maintenance or setup is required, put the welder in a "Weld Off" state, or turn unit off before adjusting weld head.

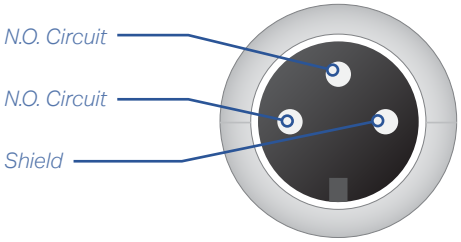
WORKSPACE CONSIDERATIONS

- Ensure workspace around the power supply is adequate for welding operation.
- Ensure enough clearance on both sides and back of power supply for cables to run.
- Good ventilation is important to keep the power supply from overheating. Be sure to have proper air flow in and around the power supply.
- Be sure to keep the work surface stable, level, free of vibration, and strong enough to support the power supply.
- Ensure the power supply is mounted the proper distance from the weld head, and incoming power.
- Avoid placing the power supply near sources of high frequency radiation.
- Keep the working area clear of excessive dust, acids, corrosive gases, salt, and any moisture.

VOLTAGE AND POWER REQUIREMENTS

The Sunstone CDDP-A welder is equipped with universal power supplies and can be used with either 110VAC or 220VAC. No voltage selection is required prior to connecting and powering on the welder. The welder will automatically detect the voltage and make the appropriate adjustments automatically.

Figure 6.1.External trigger wiring diagram. N.O. is short for "Normally Open.".



WELD ACTUATION

The CDDP-A welder is actuated by means of an external trigger port located on the back of the welder (see Figure 7.1). The trigger uses a 3 DIN connector and requires shielded wire. Figure 6.1 shows the proper pin placement for custom external trigger cables. The standard external trigger cable connector is an SD-30LP made by CUI, Inc.

What's in the Box

- Welder
- Power cord
- Foot pedal
- User manual
- Safety Guide

Figure 6.2.The CDDP-A's front panel consists of three main components:

Exploring the Welder's Front Panel

The front of the welder (see Figure 6.2) consists of three components; the digital touchscreen, the power button, and the weld on/off button.

The digital touchscreen displays the graphic user interface and allows the operator to make changes to the welding parameters. Every interaction with the weld settings will happen via the touch screen.

The power button will turn the welder on and off. When turned on, the button will latch and stay depressed. To turn the welder off, press the button again to unlatch it and turn off the welder.

Warning: *DO NOT turn the welder off during boot up. Allow the welder to completely boot up before turning it off.*

The weld on/off button can be used anytime the welder is turned on. When turned on, the button will illuminate and stay depressed and the welder will make welds. When off, the welder will perform all weld functions, but no weld energy will be released, and no welds will be made. The weld on/off button allows operators to safely make changes to welding electrodes, weld heads, and hand attachments. Operators can also perform 'dry runs' to test timing, delays, and automations, without releasing any weld energy.

Figure 7.1. On the back of the CDDP-A is where you'll find all connections to power, weld heads, triggers, and more.

Exploring the Welder's Back Panel

The back panel of the welder has a dozen different components including: Ethernet port, accessory port, PLC, E-Stop, WH Control, Primary Trigger, Secondary Trigger, Positive and Negative weld Terminals, Fuse, AC line in, and cooling fans. The back panel also show identifying details such as model number, serial number, and certification marks.

The Ethernet Port is used to control the welder with a PLC through an Ethernet connection. Additional information can be found in Chapter 11.

The **Accessory Port** can be used to connect to and communicate with external accessories.

The **PLC Port** includes logic inputs and outputs that can be used to communicate with a PLC.

The **E-Stop** can be used as an emergency stop. The E-stop is normally open and engaged. It must be closed to disengage the E-Stop. Pin out information can be found in Appendix A, page 54.

The **Weld Head Control** is used to send a trigger signal to a weld head.

The **Primary Trigger** is used to connect a foot pedal, or other switch, to initiate a weld.

The **Secondary Trigger** is used to connect a foot pedal, or other switch, to initiate a weld.

The **Positive** and **Negative Terminals** are used to connect a weld head or hand attachment to deliver the weld energy. Make sure the weld cable resistance is greater than or equal to 1 milliohm (1mΩ) of resistance.

The **Fuse** houses a 10A fuse rated for up to 250VAC.

The **Power Inlet** accepts an IEC 320 C13 power cord and can accept 90-250 VAC, 50-60 Hz.

The cooling fans must be free from obstruction and have at least two inches of free space behind the welder.

Additional information and specific pin-out diagrams can be found in Appendix A.

NOTE: *The signals and relays are configured for LOW= Ground=TRUE INPUTS. Applicable to: E-STOP, wh control, pri trigger, sec trigger. See Appendix A for additional details.*

Exploring the Side Panel

The welder features a USB port on the LEFT side, near the FRONT. See Figure 8.1. The USB port can be used for three purposes. First, operators can plug in a USB flash drive to update the firmware and software of the welder (see Chapter 10 for software update instructions). Second, operators can export and import saved schedules, welder settings, and historical weld data (see page 27 for import/export instructions). Third, operators can plug in a compatible USB mouse and use the mouse to navigate the interface.

Figure 8.1 On the left side of the CDDP-A is a USB port (A). Connect a USB flash drive here to update the firmware or software, import or export saved schedules, or to use a mouse to navigate the software interface.

How to Set Up Your Welder

Follow these initial setup steps when setting up the welder for the first time.

- Unbox the welder and place it on a secure workspace.
- Connect the E-Stop bypass plug, or an E-Stop switch into the E-Stop port on the back of the welder.
- Connect the female end of the power cord into the back of the welder and connect the male end into an AC power outlet.
- Connect the weld head or hand attachment to the welder.
- Connect one end of one weld cable to the positive terminal on the back of the welder using a ¼" bolt and nut.
- Connect one end of the other weld cable to the negative terminal on the back of the welder using a ¼" bolt and nut.
- If the other ends of the weld cables are not connected to the weld head or hand attachment, refer to that product's user manual for instruction on how to connect the weld cable.
- Determine which weld trigger configuration is best for your setup. Options include:
    - Pneumatic weld head controlled by the CDDP-A welder.
    - Fully manual operation
    - Auto with Timing option with one pedal. See next page for cable setup instructions.
    - Fully Automatic option with one pedal. See next page for cable setup instructions.
    - Manual weld head actuated
    - Two foot pedal operation: One pedal to control the weld head, one pedal to trigger weld energy. See next page for cable setup instructions.

See Control Tab for additional weld head setup options on page 20.

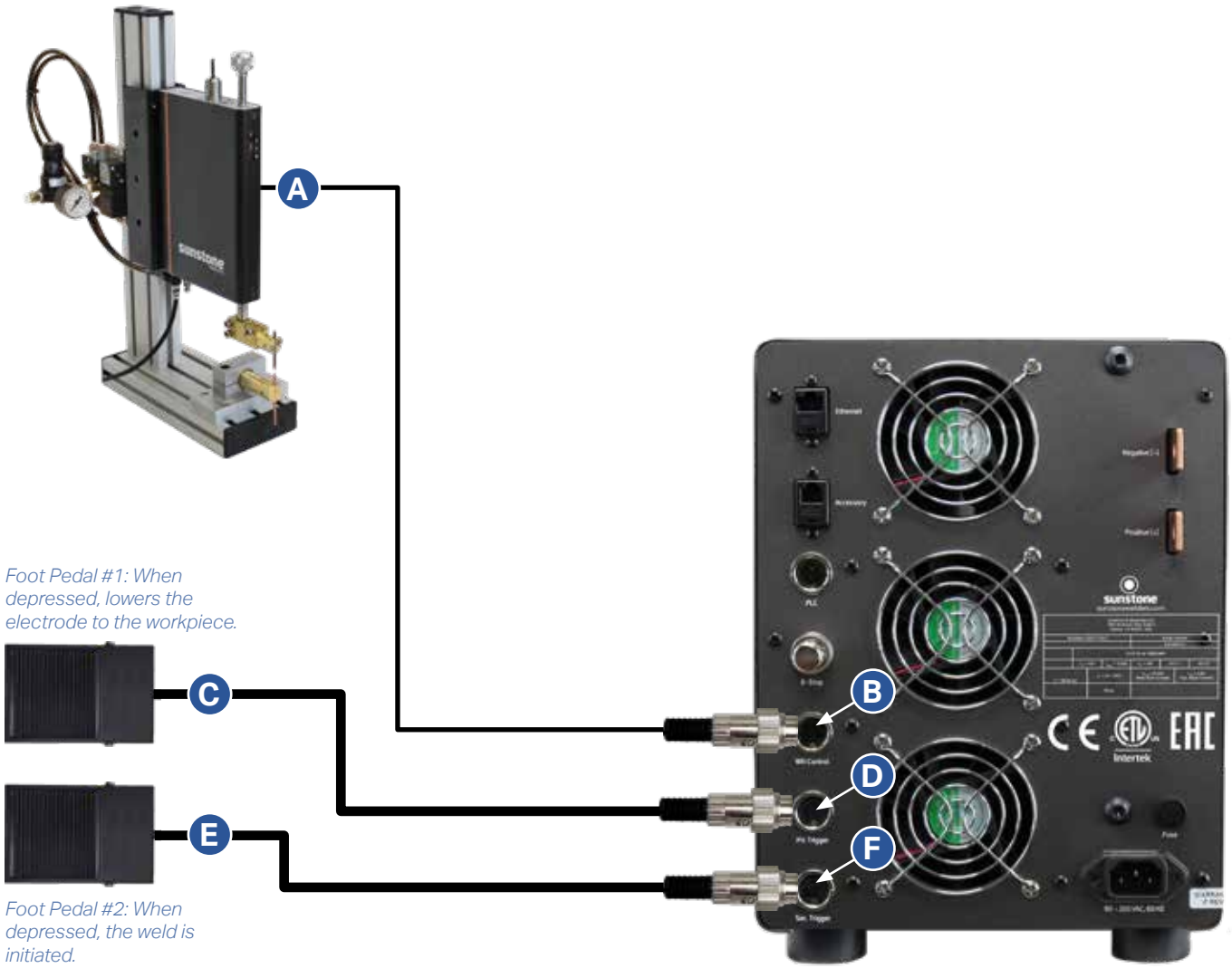
The system is now properly connected and ready to weld.

Cable Setup to Manually Initiate a Weld with Two Foot Pedals

Two-Pedal Setup

If you wish to manually initiate a weld using a foot pedal, then connect the welder and weld head cables as shown below. In this configuration, when foot pedal #1 is depressed, the CDDP-A welder will lower the electrode on the weld head. When the electrode makes contact with the workpiece, you then depress foot pedal #2 to initiate the weld.

- Connect the Weld Head Control Cable (A) to the WH Control Port (B).
- Connect Foot Pedal #1's cable (C) to the Primary Trigger Port (D).
- Connect Foot Pedal #2's cable (E) to the Secondary Trigger Port (F).



Foot Pedal #1: When depressed, lowers the electrode to the workpiece.

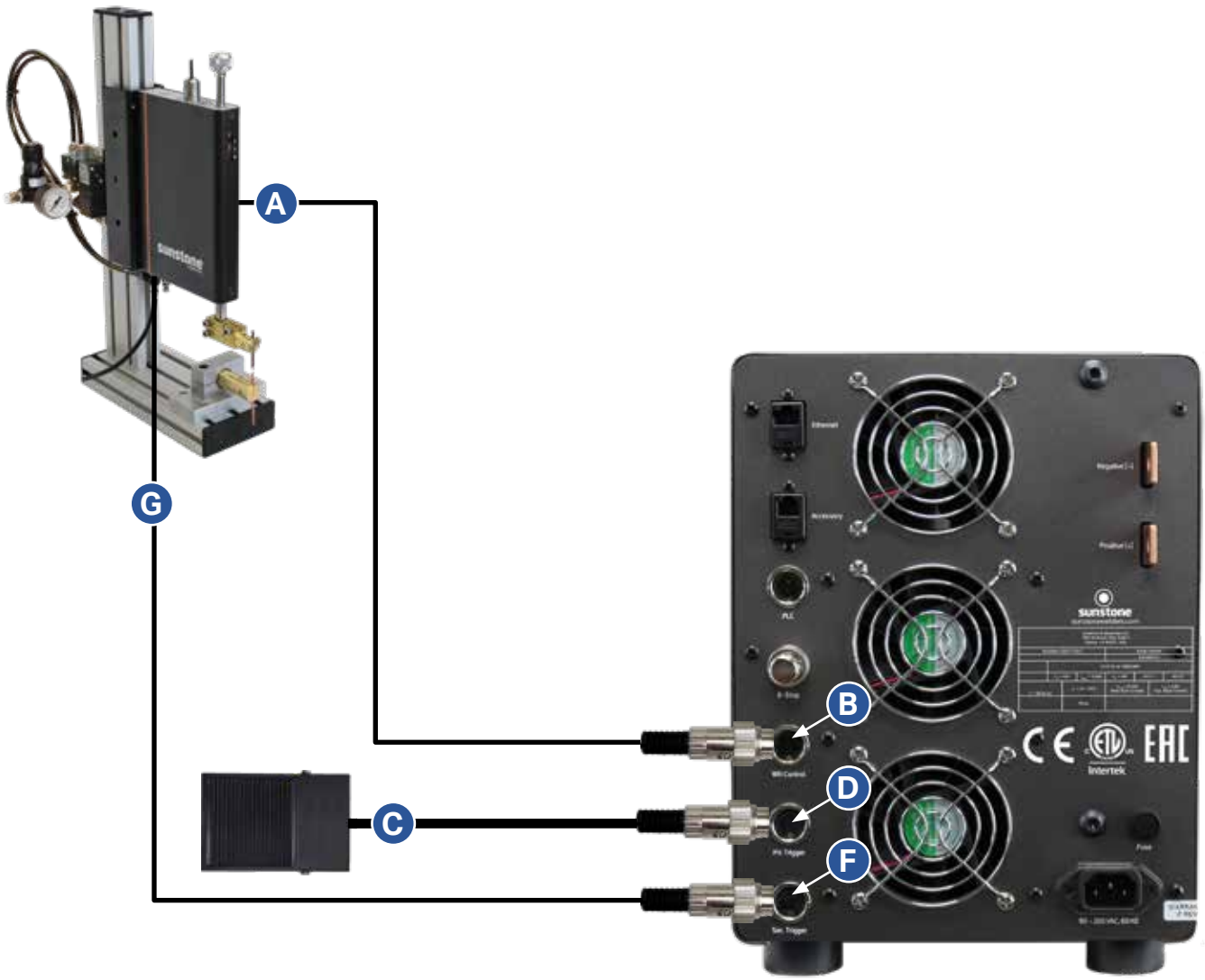
Foot Pedal #2: When depressed, the weld is initiated.

Cable Setup to Automatically Initiate a Weld with One Foot Pedal

Single-Pedal Setup

If you wish to automatically begin the welding process by depressing a foot pedal, then follow the instructions below. In this configuration, when the foot pedal is depressed, the CDDP-A welder will automatically lower the electrode on the weld head and then initiate the weld when the electrode makes contact with the workpiece.

- Connect the Weld Head Control Cable (A) to the WH Control Port (B).
- Connect Foot Pedal #1's cable (C) to the Primary Trigger Port (D).
- Connect Weld Head trigger cable (G) to the Secondary Trigger Port (F).



Chapter 3: User Interface Overview

This chapter will provide a brief overview of the different screens, parameters, and elements found on the touchscreen interface of the welder.

NAVIGATION BAR

The Navigation Bar (A), as shown in Figure 13.1, runs across the top of the screen and allows operators to switch between the following screens: Home, Communications, Media, Save/Load, Lock, Settings

HOME SCREEN

The Home Screen, as shown in Figure 13.1, includes all aspects relating to the weld energy, waveform, and timing delays. See Chapter 4 for specific details about elements of the Home Screen.

Waveform. The Waveform (B) display shows a graphical representation of the weld settings and parameters.

Pulse Settings Tab. When you click on the Pulse Settings tab, three additional energy settings tab will appear below: Total Energy, Pulse 1 Energy, and Pulse 2 Energy. Pre-weld Delay and Delay Between Pulses settings will also appear.

Comparator Tab. The Comparator tab allows operators to set acceptable values for Peak Voltage, Peak Current, and Peak Power for each weld.

Control Tab. The Control tab allows operators to make changes to the weld head configuration and timing options, as well as roll spot parameters.

COMMUNICATIONS

The Communications Screen, as shown in Figure 13.2, provides PLC controls for automation, settings for Alarms, and features for Importing/Exporting pre-set welds. See Chapter 5 for specific details about elements of the Communications Screen.

PLC. A Sunstone CDDP-A PLC's capabilities were designed to be used with a Probotix or Janome robotic table. Use this screen to enter the necessary instructions to control the table. See Chapter 5 for PLC instructions.

Figure 13.1. Homescreen with Pulse Settings Tab selected. See Chapter 4 for specific details about the Home Screen.

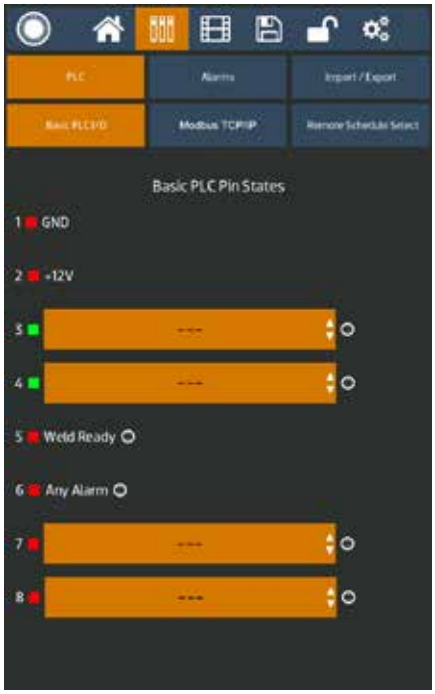


Figure 13.2. Commuications Screen with the PLC tab selected. See Chapter 5 for specific details about the Communications Screen.

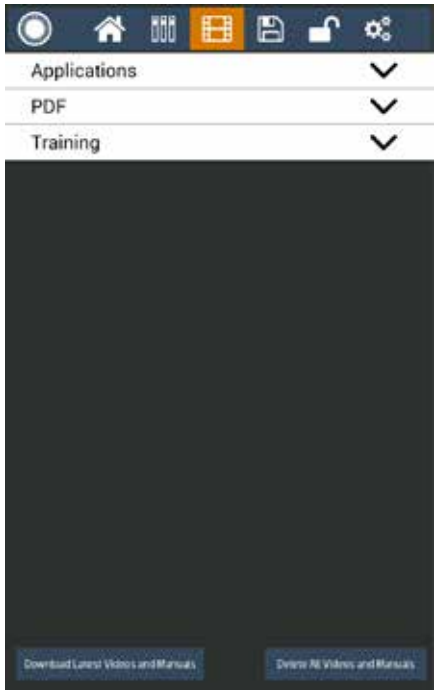


Figure 13.3. Access the Media Screen to view instructional material. See Chapter 6 for specific details about the Media Screen.

Alarms. You are able to instruct the Sunstone CDDP-A to alert you to temperature fluctuations, comparator failures, electrode sticks, and more.

Import/Export. You are able to import or export weld settings from one CDDP-A welder to another.

MEDIA

The Media Screen, as shown in Figure 13.3, provides the operator with a library of instructional application videos, user guides, and training materials. See Chapter 6 for specific details about elements of the Media Screen.

Applications. Click on Applications to view a list of available application videos.

PDF. Click on PDF to view a list of applicable manuals and other documents.

Training. Click on Training to view a list of available training material.

SAVE/LOAD

The Save/Load Screen allows you to save or load weld settings. See Chapter 7 for specific details about elements of the Save/Load Screen.

Figure 14.1.Use the Lock Screen to create/ enter a password to lock the CDDP-A's weld settings. See Chapter 8 for more information.

Figure 14.2. Settings Screen. See Chapter 9 for more information.

LOCK SCREEN

The Sunstone CDDP-A allows the operator to lock the welder, preventing others from using the welder or preventing others from changing the welder's settings. See Chapter 8 for specific details about elements of the Lock Screen.

SETTINGS SCREEN

Use the Settings Screen to modify the welder's basic settings, such as language, date and time, speaker volume, screen brightness, and more. See Chapter 9 for specific details about elements of the Settings Screen.

Chapter 4: Home Screen Operation

The Home Screen is where the operator controls all aspects relating to the weld energy, waveform, and timing delays. During operation, the Home Screen will be accessed more than any other screen.

Waveform Display

The Waveform displays a graphical representation of the settings determined for each weld parameters. See Figure 15.1. Weld Voltage is displayed on the y-axis, and pulse width (time) is displayed on the x-axis. The total energy per pulse, as displayed in the blue Info Box within the Waveform, is calculated based on the voltage and time, and is displayed next to the waveform peaks. Total energy is measured in watt-seconds (Ws).

The blue Info Box in the upper right corner of the waveform display shows the saved name of the Active Schedule (if the settings were previously saved to the welder. Also, the Info Box shows the comparator results from the previous weld (if the comparator is enabled. See page 18 for additional detail about the comparator).

If the Comparator Tab is selected, green lines will appear in the Waveform to indicate the lower limit of the comparator values. Red lines will indicate the upper limit of the comparator values. See page 18 to learn more about the Comparator.

Note: the waveform background color is orange when the Weld On/Off button is turned on and gray when the Weld On/Off button is turned off.

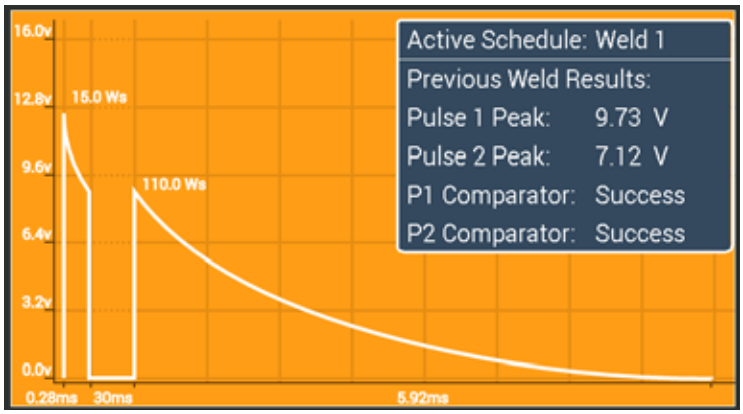


Figure 15.1.The Waveform displays a graphical representation of the weld settings. Voltage is displayed on the y-axis. Time is displayed on the x-axis.

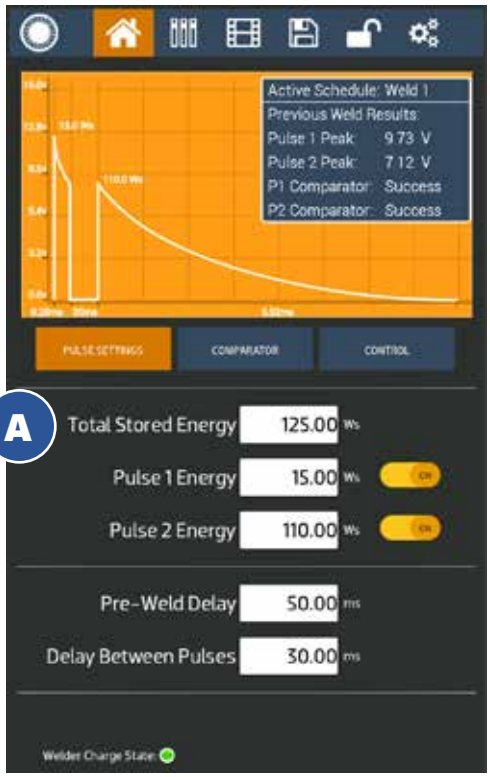


Figure 16.1. The Home Screen with the Pulse Settings Tab selected, which display energy values for the current weld.

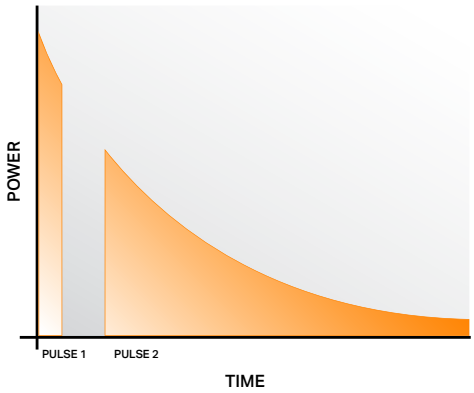


Figure 16.2. Example of dual pulse energy discharge curve.

Pulse Settings

Click on the Pulse Settings Tab to set energy release values per pulse. The Pulse Settings Tab is the default selection.

Total Stored Energy

The Total Stored Energy value (A), as shown in Figure 16.1, determines the initial peak value of the weld energy. The total stored energy will determine the maximum amount of energy that could be delivered in one weld. However, operators may choose to not use 100% of the maximum stored energy. The total energy can be set to 100% of the welders total available energy, yet the pulse 1 and pulse 2 energies do not need to equal the total stored energy value.

For example, Total energy can be set to 100Ws, Pulse 1 can be set to 5Ws, and Pulse 2 can be set to 20Ws. The actual weld energy delivered is only 25Ws (5+20), even though the total stored energy is set to 100Ws.

Higher Total Stored Energy amounts will lead to welds with more 'punch' because of the higher peak voltages. The example scenario mentioned above (Total Stored Energy of 100Ws, Pulse 1: 5Ws, Pulse 2: 20Ws) will have more initial 'punch' than a weld with Total Stored Energy of 25Ws, Pulse 1 of 5Ws, and Pulse 2 of 20Ws.

Pulse 1 and Pulse 2

Sunstone dual pulse welders have two pulse width energy controls. Each pulse can be adjusted separately or turned off if desired. Pulse 1 is adjustable between 0.1WS and 30% of Total Stored Energy. Pulse 2 is adjustable between 0.1WS and 100% of Total Stored Energy. In order for Pulse 2 to use 100% of the Total Stored Energy, Pulse 1 must be disabled. When Pulse 1 is enabled, Pulse 2 can only use the remaining Total Stored Energy (Pulse 2 Maximum Energy equals Total Stored Energy minus Pulse 1 Energy).

Using multiple pulses can increase weld quality. In dual pulse mode, Sunstone CDDP-A welders will discharge two separate times with each weld trigger/initiation. The first pulse is de-

signed to remove surface inconsistencies and contaminants which helps to displace oils, break through oxide layers, and seat the welding electrodes. See Figure 16.2 to view this type of weld graphically.

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 barely stick together. Pulse 1 energy is typically below 10% of the total available weld energy of the welder. Pulse 2 energy is typically between 50% and 70%.

Pre-Weld Delay

The Pre-Weld Delay controls the amount of time between when the weld is trigger/initiated and when the weld energy is released.

Delay Between Pulse

This delay controls the amount of time between the end of Pulse 1 and the beginning of Pulse 2. This will be represented on the waveform display. This option is only available when both pulses are enabled.

Welder Charge State

The welder charge state is a small indicator on the bottom of this screen. The indicator will display one of three colors:

- Green indicates that the welder is charged and ready to weld.
- Black indicates that the welder is not ready to weld, or the Weld On/Off button is off.
- Red indicates that the E-Stop is engaged.

Additional Weld Energy Notes

For new applications, a test weld should be performed, and the resulting weld should be evaluated for strength. To do so, perform the weld, and then try to pull the pieces apart to determine weld strength.

For example, a nickel strip welded to nickel plated steel, as 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. If the nickel 'pops' off without tearing, more energy should be used. Thicker materials should be pulled with a specific pull force requirement in mind.

Each Sunstone welder is fully adjustable between its minimum and maximum energy. Sunstone capacitive dual pulse welders have weld repetition rates of up to 650 welds/min. See page 90 for additional details on weld repetition rates.

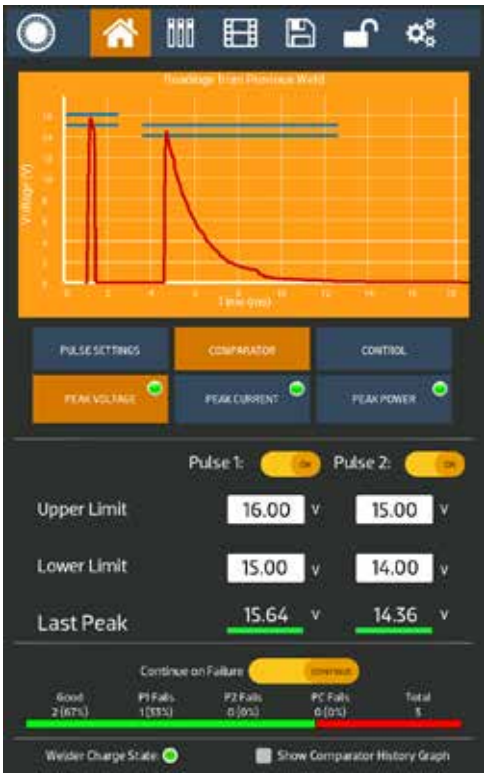


Figure 18.1. The Home Screen with the Comparator Tab and Peak Voltage sub-tab selected.

Comparator

The Comparator Screen can be used to monitor the peak weld values of the previous welds. The welder can monitor the peak voltage, peak current, and peak power simultaneously. Both Pulse 1 and Pulse 2 can be monitored.

The Comparator Screen has a similar layout to the Home screen. The Waveform displays the output from the previous weld. The values of the previous weld will be drawn on the graph in red. Horizontal blue bars will represent the lower and upper limits for the peak values. The lower and upper limits can be programmed on the lower half of this screen. See Figure 18.1.

The three tabs below the "comparator" button will toggle the input values between Peak Voltage, Peak Current, and Peak Power. The circle in the upper right of each of these buttons will display a color based on the previous weld's monitored values. A green circle indicates that the previous weld was within the limits. A red circle indicates that the previous weld was outside of the limits.

HOW TO TURN ON THE COMPARATOR

- Select the tab of the value you want to monitor (Peak Voltage, Peak Current, and/or Peak Power)
- Turn the comparator on for Pulse 1, Pulse 2, or both.
- Set the upper limit values for the pulses that will be monitored.
- Set the lower limit values for the pulses that will be monitored.

NOTE: If you are unsure of what values to set for the limits, make a dozen test welds that pass your quality control standards, and see what values are recorded. That should give you a small sample set of data to use. Next, take those values and determine how much tolerance you want to add to those values, and then set your limits based on those tolerances.

The "Last Peak" displays the monitored peak results from the last weld. The horizontal bar under the number will be green if the monitored peak value was between the upper and lower limits. The horizontal bar under the number will be red if the monitored peak value was outside of the upper and lower limits.

If Pulse 1 is found to be outside of the limits, operators can choose to continue to Pulse 2, or stop the weld and inhibit pulse 2. To do so, toggle the "Continue on Failure" button.

The results section near the bottom of the screen shows the results of past welds. The number of Good welds is listed first, both as a hard count as well as a percentage of total welds. Next is the counter for Pulse 1 fails, then Pulse 2 fails, then Part Check Fails, and finally the total count of all welds is on the far right. The horizontal color bar underneath indicates the total Good welds (Green) and Bad welds (Red).

Figure 19.1. Histogram of previous welds.

Welder Charge State

The Welder Charge State is an indicator at the very bottom of the screen, as shown in Figure 18.1 and 19.1. This indicator will display one of three colors:

- Green indicates that the welder is ready to weld.
- Black indicates that the welder is not ready to weld, or the Weld On/Off button is off.
- Red indicates that the E-Stop is engaged.

Show Comparator History Graph

The check box for the Show Comparator History Graph is on the bottom right of the screen. Checking this box will replace the Waveform with a histogram plot. See Figure 19.1. The histogram plot will show the monitored peak value for the previous welds. The histogram will plot the individual values, as well as aggregate them on the left side of the plots. The upper and lower limits are indicated with the horizontal lines, and the median value between the upper and lower values is also drawn halfway between the limits. Values that fall within the limits will be plotted with a green dot. Values outside of the limits will be plotted with a red dot. The histogram will show one or both pulses depending on which ones are enabled.

NOTE: The waveform display data and the histogram display data will change based on which tab is selected (Peak Voltage, Peak Current, and Peak Power). It is possible to have a weld that is within limits on the one tab (i.e. Peak Voltage), but not another (i.e. Peak Current).

Control

The Control tab is used to control the weld held actuation and timing. There are two sections on the Control tab: Weld Head Control and Roll Spot Control.

WELD HEAD CONTROLS

When connected to a Sunstone weld head, the CDDP-A can be connected in three different scenarios:

Scenario 1: Primary trigger actuates weld head. Secondary trigger triggers weld energy release.

Fully Manual allows the weld head descent and the weld energy release to trigger independently, commonly referred to as a "two pedal system." The first pedal controls the weld head descent, and the second signals the welder to release energy. The Squeeze Time and Hold Time inputs are disabled in Fully Manual mode.

Scenario 2: Primary trigger initiates weld sequence.

Auto With Timing is used when the entire weld process is initiated with one single pedal. Squeeze Time and Hold Time are important and need to be configured for this mode to work correctly. Pressing the pedal will begin the process. The squeeze time controls the time between when the pedal is pressed and when the weld energy is released. Make sure that the squeeze time is long enough to allow weld head to descend and apply pressure to the work piece. The Hold Time determines how long the weld head stays descended after the weld energy is released. Once the hold time is met, the weld head will ascend back up to its starting position. **See the Sunstone weld head users guide for more information.**

Scenario 3: Primary trigger initiates weld sequence.

Auto With Trigger is used when the entire weld process is initiated with one single pedal. However, Squeeze Time is not used. Instead, the internal trigger switch inside the weld head will send the weld energy release signal once the weld head reaches a predetermined force on the work piece. Hold time is used in this mode to control how long the weld head stays descended after the weld energy is released. **See the Sunstone weld head users guide for more information.**

ROLL SPOT CONTROL

Roll Spot Control is used in conjunction with a weld head or hand piece equipped with a welding wheel. To use roll spot, enable the roll spot button, and then set the welds per second input to the desired number. At higher powers, the welder can require additional time to recharge after each well, so the maximum welds per second rate may be limited. **See the Sunstone weld head users guide for more information.**

Note: The Comparator will be disabled while Roll Spot is enabled.

Each power supply is equipped with a part check feature that will verify a part is in place prior to releasing energy. This is an important feature in automated environments where an operator is not visually ensuring each part is properly placed. In order for Part Check to work as intended a Total Stored Energy must be set to a minimum of 50WS for CD1200DPA, 25WS for CD600DPA, 20WS for CD400DPA, or 15WS for CD200DPA.

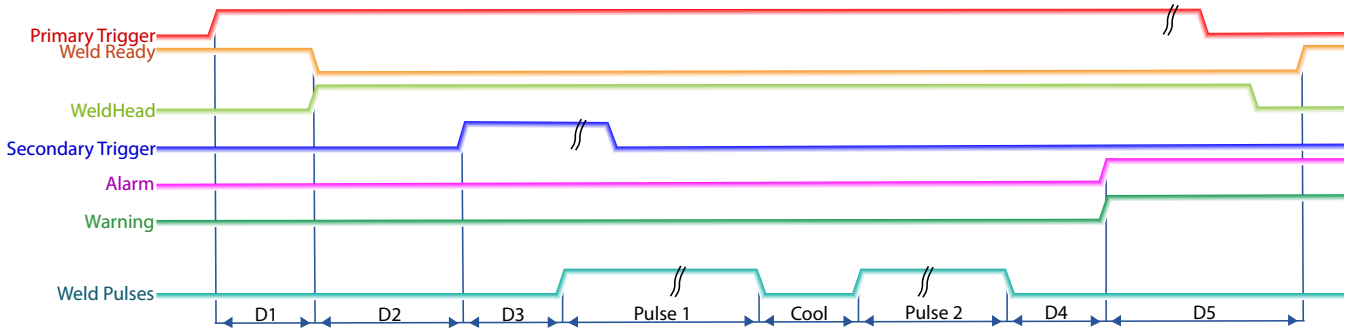


Figure 21.1. Sample timing diagram for Fully Manual scenario.

TIMING DIAGRAMS

The following timing diagrams are included to help visualize all the different steps involved when making welds. Timing diagrams for the three different weld head control options are included.

Fully Manual

Refer to Figure 21.1.

D1: A delay that occurs from the time primary trigger is triggered and the signal to the weld head is sent. Typical time for this is between 1 and 50 milliseconds.

D2: The time between when the weld head is engaged and when trigger 2 is triggered.

D3: A delay that occurs from the time the secondary trigger is triggered, and the weld occurs. Typical time for this is between 1 and 50 milliseconds.

Pulse 1: The duration of this delay is dependent on the energy programmed for Pulse 1, set in the Pulse Settings tab on the Home Screen.

Cool: The duration of this delay is dependent on the time programmed for Delay Between Pulses. The operator can select between 1 and 100 milliseconds, which will be ignored if either pulse is disabled. Control the cooling duration using the Pulse Settings tab on the Home Screen.

Pulse 2: The duration of this delay is dependent on the energy programmed for Pulse 2. This is controlled on the Pulse Settings tab on the Home Screen.

D4: After this delay, alarms and warnings are sent. Typical time for this is between 1 and 50 milliseconds.

D5: After this delay the Weld Ready signal will return to a high position. This delay will depend on the time needed to charge to the desired energy but will typically be between 50 and 5000 milliseconds.

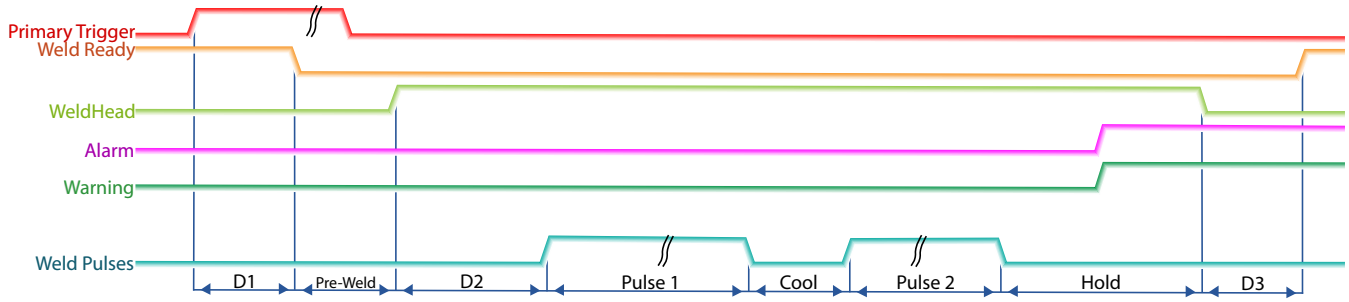


Figure 22.1. Sample timing diagram for Auto with Timing and Auto with Trigger scenarios.

Auto With Timing

Refer to Figure 22.1.

D1: A delay that occurs from the time primary trigger is triggered and the weld ready signal changes to a low value. Typical time for this is between 1 and 50 milliseconds.

Pre-Weld: An operator-defined delay that happens before the signal to the weld head is sent. This delay can be set between 1 and 10,000 milliseconds. Use the Pulse Settings tab on the Home Screen to control Pre-Weld.

Squeeze Time: An operator-defined delay that occurs from the time the weld head signal is sent and the beginning of pulse 1.

Pulse 1: The duration of this delay is dependent on the energy programmed on welder for pulse 1. This is controlled on the Pulse Settings tab on the Home Screen.

Cool: The duration of this delay is dependent on the time programmed on welder for time between pulses. The operator can select between 1 and 100 milliseconds. This time will be ignored if either pulse is disabled. Use the Pulse Settings tab on the Home Screen to set the cooling delay.

Pulse 2: The duration of this delay is dependent on the energy programmed on welder for pulse 2, controlled on the Pulse Settings tab on the Home Screen.

Hold Time: An operator-defined delay that occurs from the time pulse 2 ends and the weld head begins to return to home position.

D2: After this delay the Weld Ready signal will return to a high position. This delay will depend on the time needed to charge to the desired energy, but will typically be between 50 and 5,000 milliseconds minus the length of the hold time.

Auto with Trigger

Refer to Figure 22.1.

D1: A delay that occurs from the time primary trigger is triggered and the weld ready signal changes to a low value. Typical time for this is between 1 and 50 milliseconds.

Pre-Weld: An operator-defined delay that happens before the signal to the weld head is sent. Can be set between 1 and 10000 milliseconds, controlled using the Pulse Settings tab on the Home Screen.

D2: A delay set to allow time for the weld head to fully extend. Once the weld has fully descended, the weld discharge will be triggered. This will time out after 10,000 milliseconds.

Pulse 1: The duration of this delay is dependent on the energy programmed on welder for pulse 1. This is controlled on the Pulse Settings tab on the Home Screen.

Cool: The duration of this delay is dependent on the time programmed on welder for time between pulses. User can select between 1 and 100 milliseconds. Time is ignored if either pulse is disabled. This is controlled on the Pulse Settings tab on the Home Screen.

Pulse 2: The duration of this delay is dependent on the energy programmed on welder for pulse 2. This is controlled on the Pulse Settings tab on the Home Screen.

Hold Time: An operator-defined delay that occurs from the time pulse 2 ends and the weld head begins to return to home position.

D3: After this delay the Weld Ready signal will return to a high position. This delay will depend on the time needed to charge to the desired energy, but will typically be between 50 and 5000 milliseconds minus the length of the hold time.

Chapter 5: PLC Automation Features

Select the Communications Screen icon in the Navigation Bar to access all CDDP-A automation features. The Communications Screen has three sub sections: the PLC tab, the Alarms tab, and the Import/Export tab.

PLC Tab

The PLC Tab has two sub-tabs, the first is Basic PLC I/O and the second is Remote Schedule Select, as shown in Figure 25.1. The welder's PLC inputs (pins 3 and 4) can be used for either the PLC or the Remote Schedule Select, but not both at the same time.

BASIC PLC I/O

The Basic PLC I/O tab shows the pin states for the 8 DIN connector on the back of the power supply. Some pins are hard-coded (Pins 1, 2, 5, 6), while others have a drop-down list of options that operators can choose from (Pins 3, 4, 7, 8). The pins are labeled 1-8 and each has a color coded box. Green boxes indicate the pin is used for inputs, while red boxes indicate outputs. Some pins have a color coded circle on the right side. Green circles indicate the pin is high, and black circles indicate the pin is low.

Each pin has the following function:

- Pin1 is hard coded as the ground signal
- Pin2 is hard coded as a +12V signal

Pin3 and Pin4 can each be configured to one of the following input options:

- Clear Alarm
- Primary Trigger
- Secondary Trigger
- Lockout
- Remote Schedule Select

Note: When Remote Schedule Select is chosen, it will use both inputs. While using Remote Schedule Select the user can choose which saved welds are to be used via the "Remote Schedule Select" sub tab within the PLC main tab. (See next section for more details).

- Pin5 is hard coded as the Weld Ready signal
- Pin6 is hard coded as the Any Alarm signal

Pin7 and Pin8 can each be configured to one of the following output options:

- Weld Ready
- Weld Good
- Weld No Good
- Any Alarm
- Any Warning
- Emergency Stop
- Alarm: Temperature
- Alarm: Comparator Failures in a row
- Alarm: Electrode Stuck
- Alarm: Weld Counter Preset Limit
- Alarm: Invalid Remote Schedule Selection
- Alarm: Wrong trigger detected
- Alarm: Trigger in No Weld State
- Alarm: Part Check Failed
- Warning: Temperature
- Warning: Comparator Failures in a Row
- Warning: Weld Counter Preset Limit

For more information on pin-out and connections, please see Appendix A on page 54

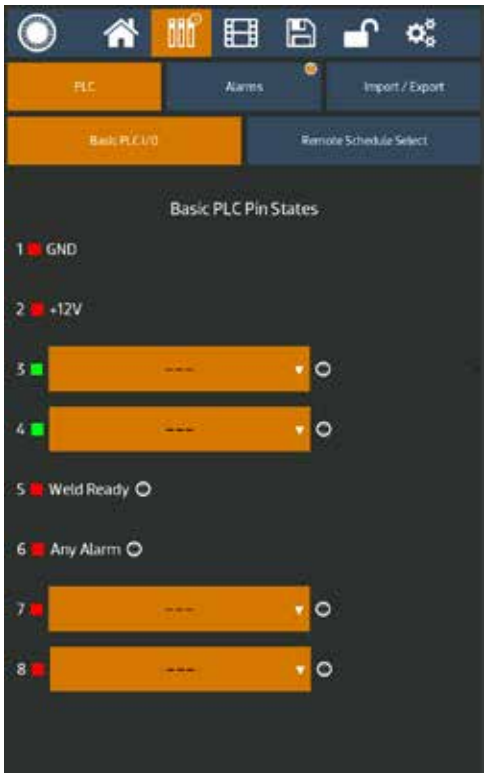


Figure 25.1. Use the Communications Screen to access all CDDP-A automation features. The Communications Screen has three sub sections: the PLC tab, the Alarms tab, and the Import/Export tab.

REMOTE SCHEDULE SELECT

The Remote Schedule Select allows operators to program up to four pre-saved schedules and recall them and switch between them via the built in PLC capabilities. See Figure 25.2. To do so, enable the Remote Schedule Select button and program each of the four dropdown menus to the desired pre-saved schedule. For instructions on saving schedules, see chapter 7.

Enabling the Remote Schedule Select will automatically change Pin3 and Pin4 on the Basic PLC I/O tab to use the remote schedule select. If the Remote Schedule Select button is later disabled, Pin3 and Pin4 will return to an unassigned state.

Figure 25.2. The Remote Schedule Select feature allows the operator to program four pre-saved schedules.

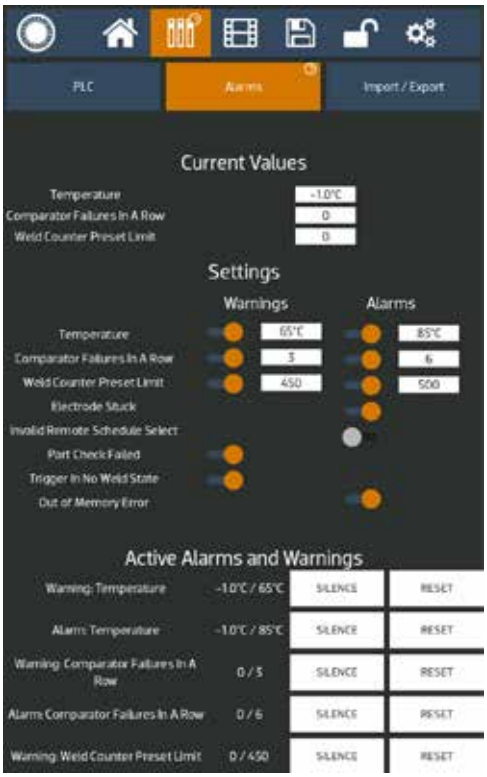


Figure 26.1. Alarms allow you to set certain power supply statuses, active warnings, active alarms, and other alarm-related settings.

To select pre-saved schedules, click on the drop down menus and select the desired saved schedule. Operators can choose 4 different schedules that are selectable through the two PLC input pins on the 8DIN connector on the back panel. These will be passed in using a bit mapping. Keep in mind that the inputs are reverse logic, so a low will actually be a '1' and a high will be a '0'.

Pin3 high(0) and Pin4 high(0) will select schedule 0

Pin3 high(0) and Pin4 low(1) will select schedule 1

Pin3 low(1) and Pin4 high(0) will select schedule 2

Pin3 low(1) and Pin4 low(1) will select schedule 3

Alarms Tab

The Alarms tab will display certain power supply statuses, active warnings, active alarms, and other alarm-related settings. As shown in Figure 26.1, the top portion of the screen displays the current temperature, comparator failures in a row, and weld count. The weld count can be reset.

The Settings portion of the screen can be used to turn different alarms on and off, and also allows to set limits for certain alarms and warnings. Parameters that show are gray circle are turned off, while orange circles indicate the parameter is turned on. The following alarms will be turned on by default: Electrode Stuck, Part Check Failed, Trigger In No Weld State, and Wrong Trigger Detected.

The bottom portion of the screen will show a list of active alarms and warnings. If there are more active alarms and warnings than can be displayed at one time, operators can scroll up and down in this section to see all the different alarms and warnings. Note that if a warning, and its corresponding alarm are both enabled and active, then only the alarm will be displayed, but the warning will be active up until the alarm is also active.

Active alarms and warnings can be cleared and reset using the PLC inputs (Pin3 or Pin4), or by toggling the switch next to the alarm in the settings portion of this same screen.

Import/Export Tab

The Import/Export tab has six buttons that can be used for different import and export functions. See Figure 27.1.

Export History will export the past weld results history to a USB stick. The export CSV file will include all weld parameters and comparator values.

History Clear will clear the past weld results history.

Clone Export will save all the welder settings, including the saved schedules to a USB stick. This function is beneficial for operators who need to have multiple identically configured power supplies.

Clone Import will take the saved and exported welder settings from a USB stick and load them onto the power supply.

Export Welds will copy all the saved weld schedules to a USB stick.

Import Welds will load saved weld schedules from a USB stick and load them into the power supply.

Figure 27.1. When you select the Import/Export tab will be able to export history, export clone information for another welder, or import clone information.

Chapter 6: How to Use the CDDP-A's Media Features

The Sunstone CDDP-A's Media feature allows the operator to access application videos, training videos, and PDF documents. To access the Media Screen, click on the Media button in the Navigation Bar. The Media Screen opens as shown in Figure 29.1.

To use the accordion-style menu, tap on the section you want to see and then scroll through the available options. For example, clicking on the Application Videos will give access to all the stored application videos.

If the welder does not display any items in any of the three sections, you might need to download the files to the power supply. Click on the "Download Latest Videos and Manuals" button on the bottom left of the screen and follow the prompts to retrieve the latest videos. The welder must have an active Wi-Fi connection to download media. See Chapter 9 for instructions on how to connect to a Wi-Fi connection.

Operators can manage the downloaded media, as shown in Figure 29.2. The button on the bottom right of the screen can be used to delete all videos and manuals. To delete an individual video or document, swipe from right to left on the file. To rearrange the media files, long press on the file and then drag it to the desired location.

When viewing a video file, the screen will display certain controls and options. See Figure 29.3. The video can be adjusted to go back or forward in time using the progress bar or the forward and backward arrows. The video can be paused or resumed using the play/pause icon.

Clicking the "Load Recommended Weld Settings" button will take the weld settings used in the video and load them on to the welder as the current schedule parameters. This is advantageous for operators who need a quick-start option when finding appropriate weld settings. Operators can search through the videos, find a similar application, load the settings used in the video, and then make minor adjustments if necessary. The back button can be pressed to exit the video viewer and go back to the main media screen.

When viewing a PDF, the screen will have a menu bar at the top, with the contents of the PDF displayed below. Certain aspects of the menu bar may be grayed out until the PDF is fully loaded, however operators can scroll through pages while the PDF is loading. The menu bar shows the current page on display and how many total pages the document has.

Operators can jump to a specific page by pressing the page number, typing in a new page number, and pressing done. The search bar can be used to search for any words within the document. The arrows to the right of

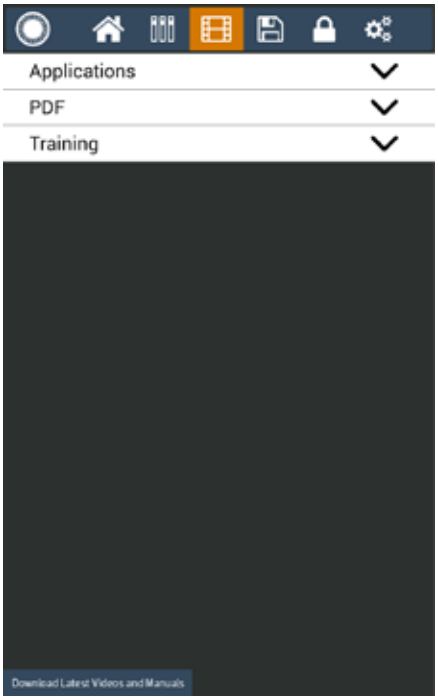


Figure 29.1. Click on the Media icon in the Navigation Bar to open the Media Screen.

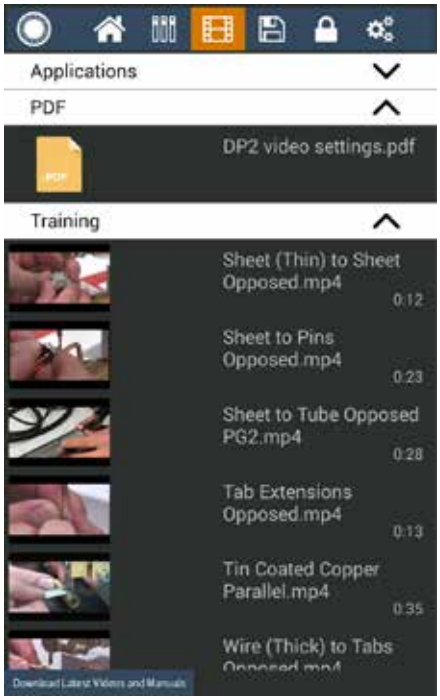


Figure 29.2. When you select the Import/ Export tab will be able to export history, export clone information for another welder, or import clone information.

Figure 29.3. When you select the Import/ Export tab will be able to export history, export clone information for another welder, or import clone information.

the search box will cycle through the search results. The “Back” button can be pressed to exit the PDF viewer and go back to the main media screen. If you touch the page number you can type in a page number and press done. The PDF viewer will navigate to that page.

Chapter 7: How to Save and Load Weld Schedules

The Save/Load screen allows operators to save and load weld schedules. A weld schedule is the collection of all settings for a particular weld, such as energy levels, delays, number of pulses, etc. Being able to save a schedule saves you the time of having to re-enter preferred settings for a particular weld. The save and load options are displayed on the same screen at the same time. See Figure 30.1

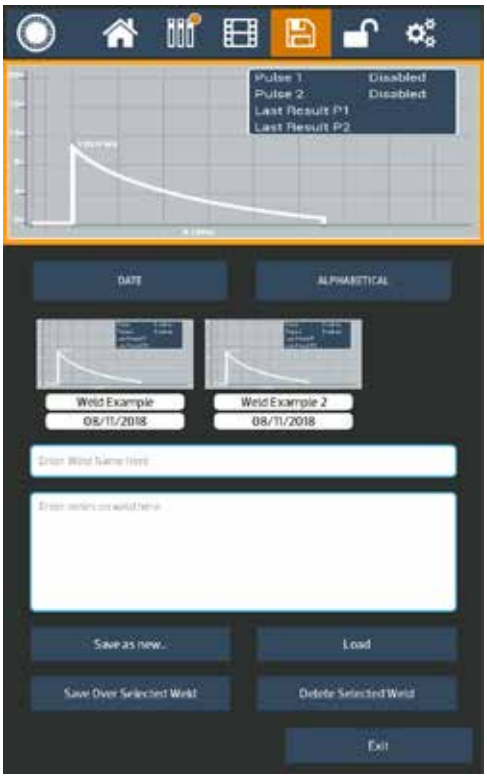


Figure 30.1. With the Sunstone CDDP-A you can save a particular weld schedule and retrieve it at any time.

The top portion of the screen displays the waveform of the current settings as programmed on the Home Screen, or the selected settings of the previously saved weld schedule, if the operator has tapped on a previously saved schedule. The previously saved schedules will be displayed along the very center of the screen and can be scrolled through by swiping left or right.

Operators can choose to list the saved schedules by date or by alphabetical order by selecting one of the two buttons below the waveform image and above the saved schedules.

To save a new schedule, type the desired name in the “Enter Weld Name Here” box. Any custom notes can be typed into the “Enter notes on weld here” box. Next, choose “Save as new...”. The schedule will now be added and displayed in the list of saved schedules.

To save over an existing weld, tap on the previously saved schedule, edit the name and or notes, and then tap the “Save Over Selected Weld” button. A message will popup on the screen asking for confirmation before allowing the weld to be edited and saved.

To load an existing weld schedule, tap on a previously saved schedule and then tap the “Load” button.

To delete an existing weld schedule, tap on the previously saved schedule and then tap the “Delete Selected Weld” button. A message will popup on the screen asking for confirmation before deleting the weld schedule.

If an operator attempts to save a new schedule with the same name as a previously saved schedule, a message will popup to notify the operator that a “(1)” was attached to the end of the name before being saved. If this happens, tap the Okay button. To edit the name, select the newly saved schedule with the “(1)” at the end, change the name, and tap the “Save Over Selected Weld” button.

Chapter 8: Lock Screen

The Lock Screen can be used to limit an operator's ability to make changes to the welder's settings. To access the Lock Screen, press the Lock Button in the Navigation Bar, as shown in Figure 32.1.

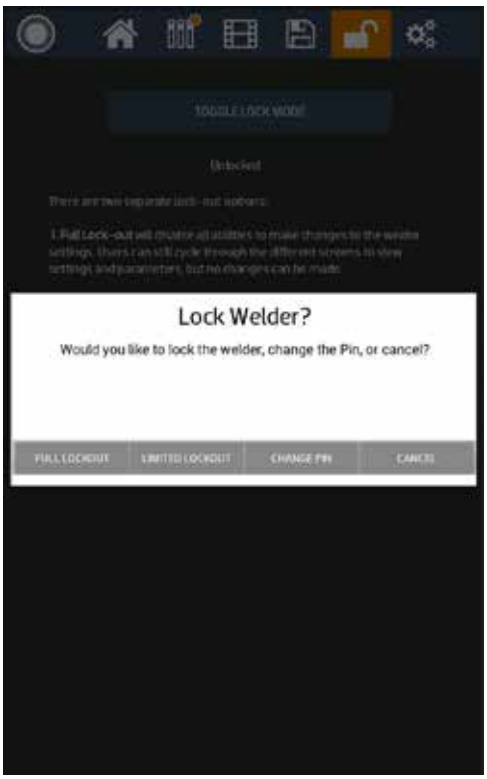


Figure 32.1. You can lock the CDDP-A, which prevents other operators from either using the welder or changing the weld settings.

The welder has two lockout options: Full Lock, and Limited Lock.

Full Lock blocks the operator from making changes to the welder settings. Operators can still cycle through the different screens to view settings and the parameters, but no changes can be made.

Limited Lock blocks the operator from making changes to the welder settings, with the exception that operators can load previously saved weld schedules. This option is best when operators need to weld with different schedules, but are not allowed to make any changes to the schedules.

The current lock state is displayed on this screen below the blue button. If neither lock option is turned on, the welder will display that it is "Unlocked."

How to Lock the Welder

- Tap on the blue bar at the top of this screen. A popup message will appear and will show the different lock options.
- Tap on the desired option and follow the screen prompts. The options include: Full Lockout, Limited Lockout, Change PIN, and Cancel.
- The CDDP-A will ask for you to enter a PIN (Personal Identification Number) when you select Full Lockout,

Limited lockout or change PIN. The PIN must be a 4 digit number. To bring up the number pad, tap on the white space or the “Enter PIN Here” text.

- Next, enter a PIN and then select “Okay.”
- Press the cancel button to go back to the lock screen.

If the Lockout mode is enabled, and an operator tries to make changes, a popup message will appear. Operators can dismiss the message, or navigate directly to the lock screen where the PIN can be input to unlock the welder.

If you forget your PIN call Sunstone Customer Service for assistance.

Chapter 9: How to Make System Changes

The Settings Screen can be used to make changes to the general power supply settings. To make changes to the welder's general settings, press the Settings Button in the Navigation Bar. The Settings Screen will appear, as shown in Figure 34.1.

Figure 34.1. The Settings Screen can be used to make changes to the general power supply settings.

Interface Tab

Select the Interface Tab to choose the desired language, speaker volume, and the brightness of the touchscreen.

System Tab

The System Tab has the following buttons:

Restore All Defaults. This button restores all settings to the factory defaults.

Clear All Memory. This button clears all memory including saved schedules.

Update Welder. This button will update the unit via inserting a USB flash drive.

Update Welder over Wi-Fi. This button will update the unit via a Wi-Fi connection. Note that the power supply must be connected to a Wi-Fi connection with Internet access. A popup message will appear with prompts and inputs to connect to a Wi-Fi connection.

Enter Test Suite. The Test Suite is helpful for diagnostics and technical support and can only be accessed with a password. Contact Sunstone Support if this password is needed.

The System information is displayed at the bottom of the Settings Screen.

Chapter 10: How to Update the Welder's Software

The Sunstone CDDP-A software is updated from time to time as needed. You can update the software using a USB storage device or via a Wi-Fi connection.

Note: Software updates are made available to Sunstone Circle customers. To learn more about the Sunstone Circle, visit www.sunstonewelders.com/circle or call 801-658-0015.

Updating via a USB storage device

- With the welder on, insert a USB storage drive containing the update files into the USB slot on the left, front side of the unit.
- Press the Settings Button in the Navigation Bar.
- Press "Update Welder."
- At this stage, you'll wait approximately 20 seconds for the welder to do a quick systems check.
- When the check is complete, the welder will prompt you to update. Press "Install".
- The welder will begin to update. Once the update is completed the welder will display the following message: "Error – Please contact Sunstone Customer Support." **Don't call Sunstone Customer Service.** Disregard the message and ontinue to the next bullet point.
- Turn the unit off and wait 10 seconds.
- Remove the USB storage device.
- Turn the unit on.
- The updated software will now launch, which may take a few minutes.
- Once the new software is launched the following message will appear: "Firmware upgrading".
- Once completed, a message will appear letting you know the process was successful.

Updating Over Wi-Fi

- Press the Settings Button in the Navigation Bar.
- Press "Update Welder."

- Tap the “Update over Wi-Fi” button. If the welder is not connected to a network a popup message will appear. The popup window will display all the available networks and allow you to choose from one of them. If you do not see your network or your network is hidden, you can choose “Other Network” to manually type in your network SSID. Enter your password to log into your network and press “Okay”.
- If the welder is already using the most up to date software, a popup will appear stating that “There are no new files to download. You are already up-to-date.”
- If the welder is not already using the most up to date software, a popup with a progress bar will appear and display the status of the download.
- Once the update file is downloaded and the progress bar reaches 100%, a new message will appear and display the status of the update.

Chapter 11: How to Configure an Ethernet Connection

The Sunstone CDDP-A welder can be connected to and controlled by a computer using an Ethernet connection. A Sunstone weld head connected to the welder can also be controlled by this connection. Follow the instructions below to setup and configure the Ethernet connection. Additional Ethernet information, specific to the Modbus messaging software, can be found in Appendix C.

Setup and Configuration

1. Power on the CDDP-A welder.
2. Touch the Communications Button in the Navigation Bar to open the Communication Screen.
3. Select the PLC tab and then select the Modbus TCP/IP sub tab. See Figure 37.1.
4. Enter the welder's static IP address, which you can retrieve from your Network Administrator. Typical Routers default to IP address of 192.168.0.2 through 192.168.0.254. **Be careful not to assign an IP address that is already in use on your network.**
5. Input the Subnet address of the welder. Typical routers default this to 255.255.255.0.
6. Input the Gateway of the network that the welder is connected to. Retrieve this from your Network Administrator. The Gateway will typically be the first IP number in the subnet mask. For example 192.168.0.1
7. The default port for Modbus is 502. You can enter any number; however, port 502 will still be available to use even with an additional port defined. Available port values are 502 and 1025 through 65535.

Figure 37.1. To configure an ethernet connection, access the Modbus TCP/IP screen by pressing the Communications Button, and then the PLC button.

8. Enter the Priority IP Address One, which is the IP address that will have priority when communicating with the CDDP-A.
9. Enter the Priority IP Address Two, which is the second IP address that will have priority when communicating with the CDDP-A.
10. Enter the Idle Timeout value, in minutes. The Idle Timeout is the amount of time that elapses after a connection has been lost and before the Modbus will close the connection, typically one minute.
11. Determine if you should enable White Listed IP Addresses. If this box is NOT checked, then all IP address within the network will be able to connect to the CDDP-A. If this IS checked only the IP addresses listed below will be able to connect to the CDDP-A. You can enter up to six IP addresses that will be allowed to connect to the CDDP-A. If you wish to view a list of what devises are already connected to the welder, press the Connected Devices button. If any device is connected to the welder a light will appear next to the Connected Devices button. If not devices are connected the light will be off.
12. Once the above settings have been entered, press the Submit Modbus Settings button to submit and save all settings. At this point the CDDPA is ready to connect and communicate through the Ethernet/IP connection.
13. Plug the CDDPA Ethernet port into the network using a Cat5e/Cat6 cable.

Note: You can control the CDDP-A using many different software applications. In this documentation, instructions will be provided for three: Modbus Server Tester, Modbus Poll, and Simply Modbus TCP Client.

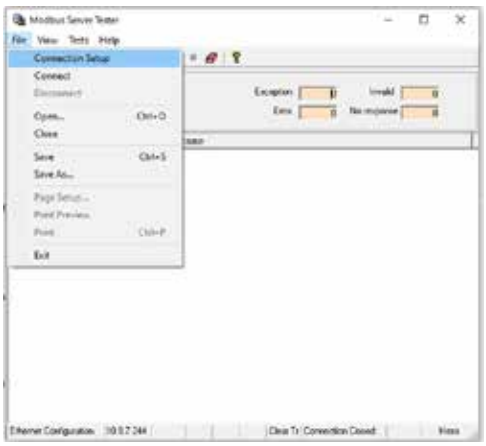


Figure 38.1. Open the Modbus/TCP Diagnostic Tool, then choose File, Connection Setup to access the Configuration screen.

Using the Modbus Server Tester

SETUP THE COMPUTER/PLC

- Power on a computer connected to the same network as the welder.
- Install and open the Modbus/TCP Server Diagnostic Tool. You can find this software at https://modbus.org/toolkit.php. The diagnostic tool allows you to communicate with the CDDP-A. While the diagnostic tool is for testing, and not intended for a production environment, it is useful to show communication between Modbus and the CDDP-A.
- The diagnostic tool will display the Configuration screen. If not, choose Connection Setup from the File menu. See Figure 38.1.
- Type in the IP address used in the Welder IP Information screen. In this guide, 10.9.7.244 was used. The other two

fields can be left at default: 60 second timeout and Slave Address of "FF". See Figure 39.1.

- Once you click OK a quick message will appear and then close once a connection has been established. If you encounter an error, check your network connection and Welder IP Information and try again. You will know that you are connected when the connection icon is greyed out and the disconnect icon is colorful. You can also tell by going to the file drop down menu and noticing that "Connect" is greyed out and the "Disconnect" is not greyed out.

Figure 39.1. The Modbus Configuration screen.

RETRIEVING INFORMATION FROM THE CDDP-A

With configuration completed, you are now ready to communicate with the CDDP-A through Ethernet/IP using the Modbus standards. Refer to Appendix C, Modbus Data Tables, for all functions and commands.

Throughout these instructions, addresses and values will be in hex format. The program inputs will appear as a decimal, but they are a hex number. If you see "0x" before a value, it signifies that the number is hex, but the "0x" cannot be typed into the program (Ex. a 0x0011 hex number will be written in the program as 0011).

- To begin, click on the Send Frame icon (A) in top toolbar. See Figure. 39.2.
- In the Send New Frame window (see Figure 38.1), keep the default settings of "1" Times with "100" ms of Delay. Click on the "01 Read discrete Outputs". A new Request Data window will appear where you can input a function code, starting address, and quantity of outputs. See Figure 40.2.
- Keep the function code "01". If you look at the Modbus Appendix C, the Read Coils Table on page 65, you will see that the table defines what coil is pulled from the CDDP-A when reading from coils 0 through 23. If you choose "0000" as the starting address and "0001" as the quantity of outputs, then you will see a reply from the CDDP-A of the Pulse 1 Power Comparator Enable boolean. The reply will be 1 "True" if enabled "checked" and 0 "False" if disabled "Not checked". Once you're done typing in the information click on Finish.

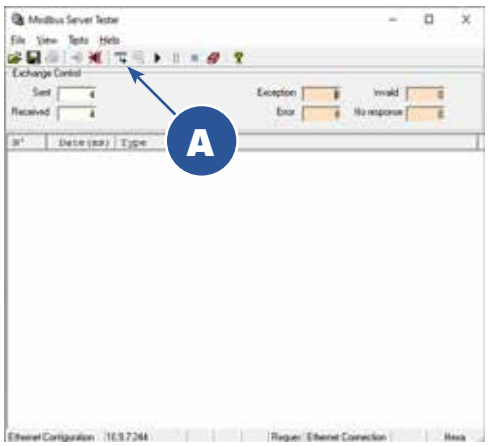


Figure 39.2. Send Frame icon.

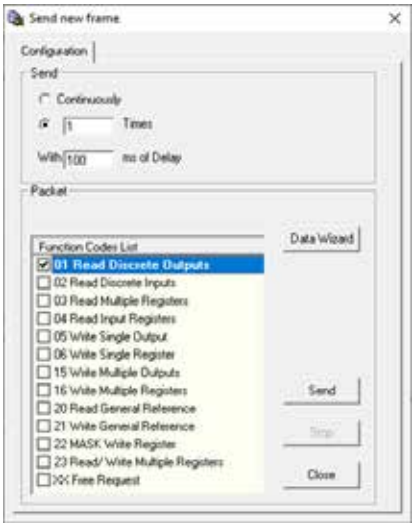


Figure 40.1. Send New Frame window.

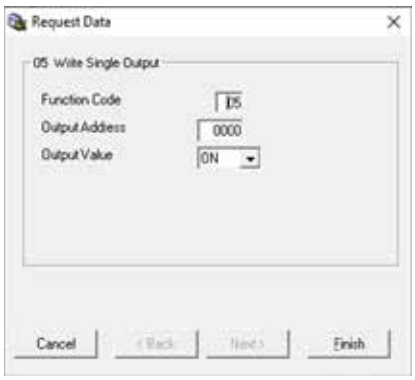


Figure 40.2. Request Data window.

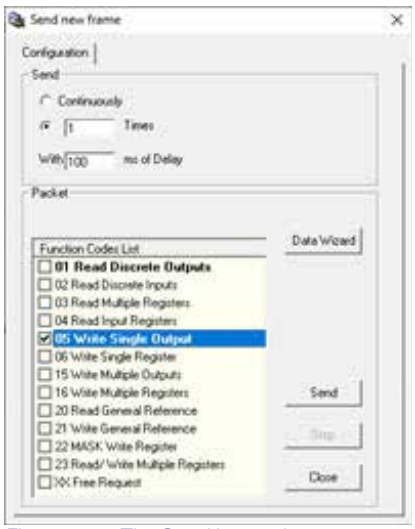


Figure 40.3. The Send button becomes active when you select a Function Code.

- You will then need to check the box next to "01 Read Discrete Outputs". Once checked, the Send button is not greyed out anymore.
- Click the Send button.
- The request, denoted as "Req," is displayed on the main window along with a response, denoted as "Resp." On the response line, look at the last two bytes of information with the response of 0x01, representing "True," that Pulse 1 Power Comparator is enabled. On the welder's Home screen, with the Comparator tab selected, you will see that Pulse 1 Power Comparator is enabled.
- Disable Pulse 1 Power Comparator on the welder by going to the Comparator screen on the welder and toggling to "off".
- Click the Send Frame icon. See Figure 39.2.
- In the Send New Frame window (Figure 40.1), click on the Send button to send the same request as before.
- Notice now, in the main window, that the response in the main window is 0x00 False and the Pulse 1 Power Comparator is disabled.

SENDING INFORMATION TO THE CDDP-A

- Press the "Send Frame" icon
- Keep the default settings of "1" Times with "100" ms of Delay. Click on "05 Write Single Output". The Request Data window will appear. Enter a function code, output address, and output value, as shown in Figure 40.2.
- Keep the function code "05", which if you look at the Modbus documentation for the CDDP-A is for the "Write Single Coil" function. If you go further into the Modbus document you will find a Coils Table on page 61 that defines what coil is written to the CDDP-A when writing to coils 0 through 23. If you choose "0000" as the output address and "ON" as the output value, the "Pulse 1 Power Comparator Enable" is enabled.
- Click Finish when you've entered all data. The Send New Frame window re-appears. Check the box next to "05 Write Single Output". Once checked the Send button is active, as shown in Figure 40.3.

- Click the Send button.
- The request you just entered will be displayed in the main window of the Modbus Server Tester app, along with a response. Both the request and response should match, as highlighted in Figure 41.1. The 0xFF signifies that a "ON" true was sent Notice that the CDDP-A's Home screen will indicate that the Pulse 1 Power Comparator is enabled, as shown in Figure 41.2.

If you write to the same output address but change the output value to "OFF" and hit "Send" you will notice that the Pulse 1 Power Comparator on the welder is now disabled. Further, the output windows will display a 0x00 instead of 0xFF in the request and response, signifying that a "OFF" false was sent.

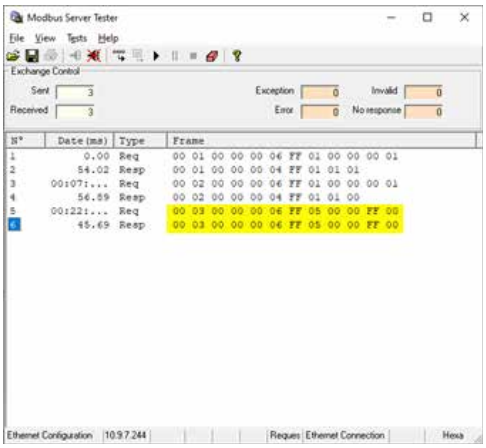


Figure 41.1.

READING THE OUTPUT WINDOW: REQUESTS AND RESPONSES

Each time you send a request the first two columns of data in the Frame section will increment (A), as highlighted in Figure 41.2.

The third through seventh columns in the Frame section is part of the header that is sent/received (B) as shown in Figure 41.2.

The column after the columns with "FF" data, or the eight column, is the Function code (C) as shown in Figure 41.2.

The next column (D) is the byte count, as shown in Figure 41.2. The next column (E) shows the 2 bytes received when reading the coil.

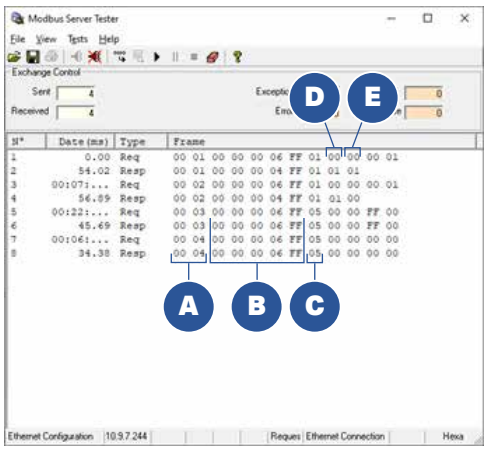


Figure 41.2.

When writing to a single coil output, the request and response will match with either 0xFF ON or 0x00 OFF when writing to a single coil. See highlighted section in Figure 41.3.

READING THE INPUT REGISTER

Follow these steps to read from the Input Register Function Code.

- Send a new frame by clicking on the Send Frame icon in the upper toolbar.
- In the Send New Frame window, select 04 Read Input Registers.

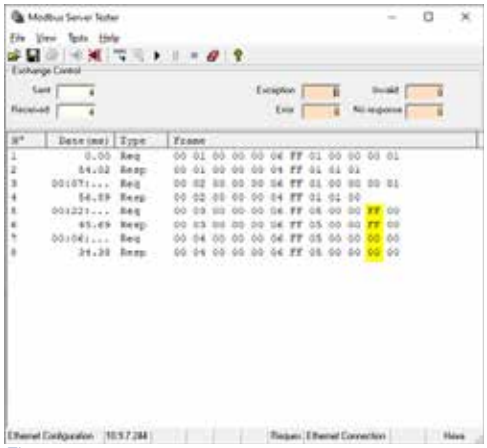


Figure 41.3.

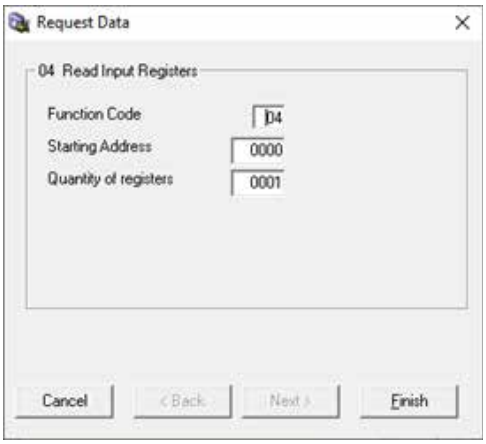


Figure 42.1.

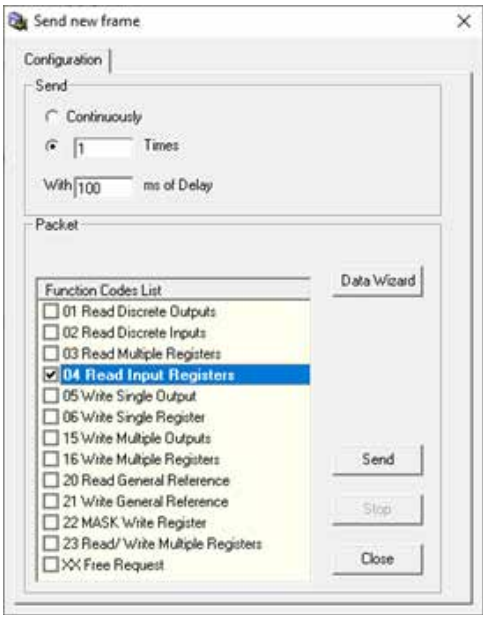


Figure 42.2.

Figure 42.3.

- The Request Data window will appear. See Figure 42.1. The Function Code is 04, Starting Address is 0000, and Quantity of registers is 0001. Looking at the Input Register table in Appendix C on page 60, note the capacitor charge voltage is being read.
- Click the Finish button.
- In the Send New Frame window, check the box next to 04 Read Input Registers. See Figure 42.2.
- Click the Send button.

Once you've entered this data, the output window displays the hex value 0x25D2 converts to 9682mV or 9.682V. Consequently, if you look at the CDDP-A's Home screen and weld form graph (see Figure 42.3), notice that the peak is close to 9.6V, so 9.682V is correct.

If you change the energy to 100ws, pulse 2 to 100ws, and turn off Pulse 1, the voltage is now between 9.6V and 12.8V.

Reading the same input register returns the result of 0x2BAC which converts to 11180 mV or 11.18V, which is between 9.6V and 12.8V.

HOW TO READ/WRITE TO A HOLDING REGISTER

This section explains how to write to a holding register and then read it back to confirm the change happened.

- Send a new frame by clicking on the Send Frame icon in the upper toolbar.
- Select 16 Write Multiple Registers.
- The Request Data window will appear. Retain the function code 10, but change the Starting Address to "000F" for "Energy Total mWs". This register happens to be one of only three registers that are 32 bit, which sends two 16 bit numbers by utilizing two registers. Change the quantity of registers to "0002". Byte count will be 4. Click on "Next".
- The Define Data (16 bits register) window will appear. In this example, you wish to send 132ws, so 132000 milli ws in hex is 0x203A0. Send this data in two parts, so "0002" will be sent for the first 2 bytes (WORD) and "03A0" will be sent as second 2 bytes (WORD). Type

those into the inputs, as shown in Figure 43.1. Click Finish. The Modbus Server Tester output window appears. Looking at the output window, you will see that the request had 0x0203A0 and that the response was valid, as highlighted in Figure 43.2.

- Next, read those registers back by clicking on the Send Frame icon and click on 03 Read Multiple Registers in the Send New Frame window.
- The Request Data window will appear. The function code stays “03”, the starting address is “000F” and the quantity of register is “0002”. Click Finish.
- The Send New Frame window will appear. Click the Send button and then review the output window. Notice 0x0203A0 in response, which is the same as value sent, as highlighted in Figure 43.3.

Figure 43.1. Use the Define Data window to convert a 32 bit register to 16 bit.

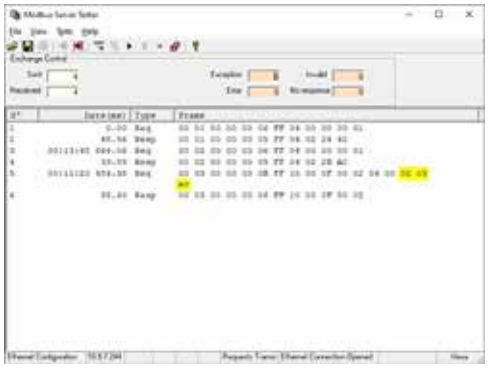


Figure 43.2.

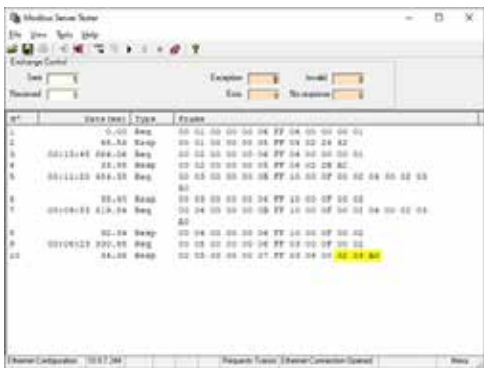


Figure 43.3.

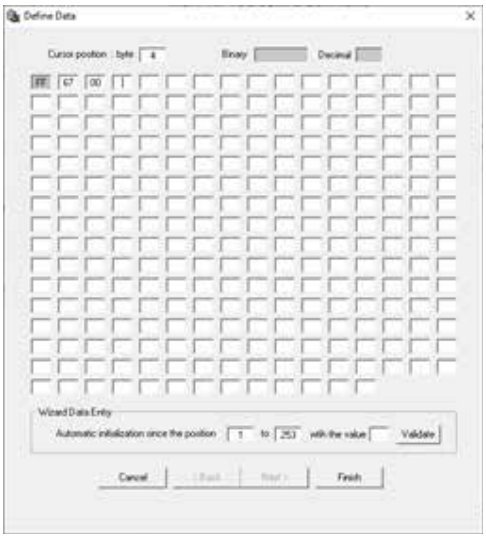


Figure 44.1. Define Data window.

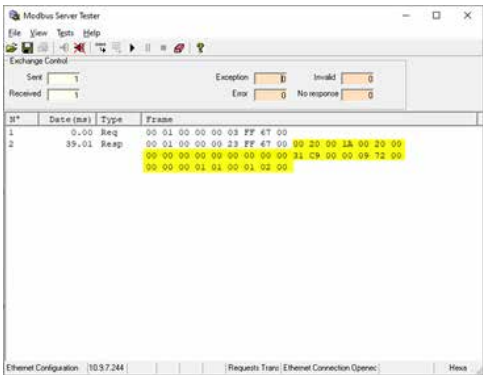


Figure 44.2. Output window showing data retrieved from the CDDP-A.

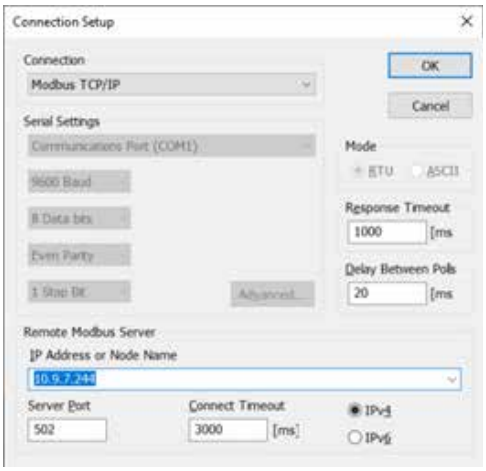


Figure 44.3. Modbus Poll Connection Setup.

RETRIEVING GENERAL INFORMATION FROM THE CDDP-A

The Modbus Server Tester software is able to read general information from the CDDP-A welder. Follow these instructions to access information stored on the CDDP-A:

- Send a new frame by clicking on the Send Frame icon in the upper toolbar.
- In the Send New Frame window, select XX Free Request. The Define Data window appears, as shown in Figure 44.1.
- In the Define Data window, type the identifier “FF” into the first input and then type in the function code “67” into the second input followed by “00” in the third input as an ending. The identifier and ending will be the same for function codes 0x41 through 0x6E. Once you’ve typed the info in click on a blank input to activate the Finish button. Click on Finish.
- In the Send New Frame window, check the box next to XX Free Request then click on the Send button.

The output window will appear and reflect the information retrieved from the CDDP-A . The first part of the response reflects the request. All data after 0xFF6700 is found in the General Info Table on page 75 in Appendix C.

Using Modbus Poll

The second piece of software that can be used to control the CDDP-A is Modbus Poll, a good example of a program that continues to poll information from/to the CDDP-A. Paid and trial versions of the Modbus Poll are available at https://www.modbustools.com/download.html

After you've installed Modbus Poll, following these instructions to connect to and control the CDDP-A welder.

SETUP A CONNECTION

- Click on the Connection menu to display the Connection Setup window, as shown in Figure 44.3.
- Select Modbus TCP/IP from the Connection menu.
- Retain the Serial Settings defaults.
- Input the CDDP-A's IP address into the IP Address or Node Name space.
- Click the OK button to save the settings.

READING COILS

Coils are names for memory addresses, or pre-defined variable names. In short a coil is a boolean (bit) variable. Follow these instructions on how to access coils.

- Click on the Setup menu and choose Read/Write Definition. The Read/Write Definition window will appear. See Figure 45.1.
- In the Read/Write Definition window, click on 01 Read Coils in the Function drop down menu box.
- Change the Quantity to 24.
- Verify the Read/Write Disabled box is unchecked. With the Read/Write Disabled box not checked, the software will continue to poll the inputs every one second.
- Click the Apply button.
- Click the OK button to accept all changes.

In the Modbus Poll main window (see Figure 45.2), coil 0x0000 is on the top left and has a value of 0, so Pulse 1 Power Comparator Enable is Off "0x00". Further down that column you will see

Figure 45.1. Read/Write Definition window.

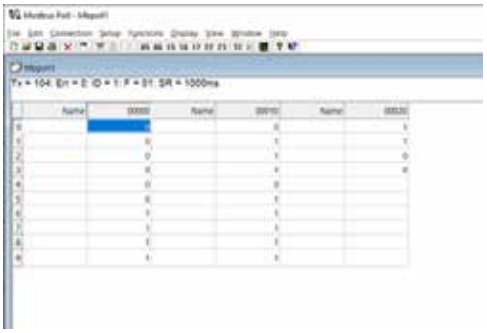


Figure 45.2.

Figure 45.3.

Figure 46.1. Read/Write Definition window.

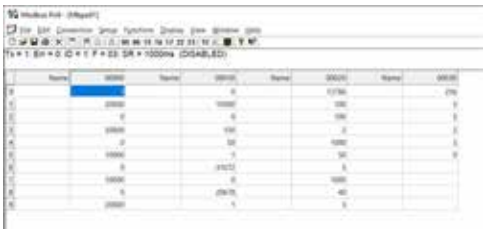


Figure 46.2.

Figure 46.3.

data for coils 0 through 9. Coil 10 starts on the next column and Coil 20 on the third column. On the CDDP-A Home screen (see Figure 45.3), notice that the Pulse 1 Power Comparator is OFF.

READING HOLDING REGISTERS

A holding register is used to designate a WORD reference that can be assigned to an output address or to an internal reference address. Holding registers are usually comprised of 16-bit words containing a decimal value between 1 and 65535.

Use the following instructions to read holding registers:

- Click on the Setup menu and choose Read/Write Definition. The Read/Write Definition window will appear.
- As shown in figure 46.1, in the Read/Write Definition window, click on 03 Read Holding Registers in the Function drop down menu box.
- Enter 0 in the Address box.
- Enter 36 in the Quantity box.
- Check the Read/Write Disabled box.
- Click the Apply button.
- Click the Read/Write Once button.
- Click on OK to save all settings.

Changes you've made to the holding registers can now viewed in the main table, as shown in Figure 46.2. Column "00000" and row "0" is Remote Schedule Select Mode and it is "1" so it is in Basic mode. All registers can be see on the table. On the CDDP-A Communication screen that Remote Schedule Select Mode is se to the Basic mode, as shown in Figure 46.3.

WRITE SINGLE COIL

To write a single coil, follow these instructions:

- Click on the Setup menu and choose Read/Write Definition. The Read/Write Definition window will appear.
- As shown in Figure 47.1, Click on 05 Write Single Coil in the Function drop down menu box.
- Enter 0 in the Address box.
- Enter 1 in the Quantity box.

- Check the Read/Write Disabled box.
- Click the Apply button.
- Click on OK to save all settings. The main window will appear.
- In the main window, click on Column 00000 and row 0 cell and enter 1.
- Click on the Setup menu and choose Read/Write Once, which then sends an "ON" instruction to the CDDP-A to select Pulse 1 Comparator Enable.

WRITE SINGLE REGISTER

To write to a single register, follow these instructions:

- Click on the Setup menu and choose Read/Write Definition. The Read/Write Definition window will appear.
- As shown in Figure 47.2, Click on 06 Write Single Register in the Function drop down menu box.
- Enter 0 in the Address box.
- Enter 1 in the Quantity box.
- Check the Read/Write Disabled box.
- Click the Apply button.
- Click on OK to save all settings. The main window will appear.
- In the main window, click on Column 00000 and row 0 cell and enter 1.
- Click on the Setup menu and choose Read/Write Once (or press F6), which then sends to the CDDP-A a 1 to turn on the Remote Schedule Select Mode, which is Basic. If you place a 0 in the cell and Read/Write Once (F6) again, the Remote Schedule Select Mode in the CDDP-A will be turned off.

Tip: You can also write to a register by double clicking on the cell containing the "1" to open the Write Single Register window, wherein you can type in a value and click the Send button.

RECEIVING GENERAL PACKET

This version of Modbus Poll doesn't allow custom function code with more than one data type to be used.

Figure 47.1. Settings for writing to a single coil using the Read/Wrtie Definition window..

Figure 47.2. Settings for writing to a single register using the Read/Wrtie Definition window.

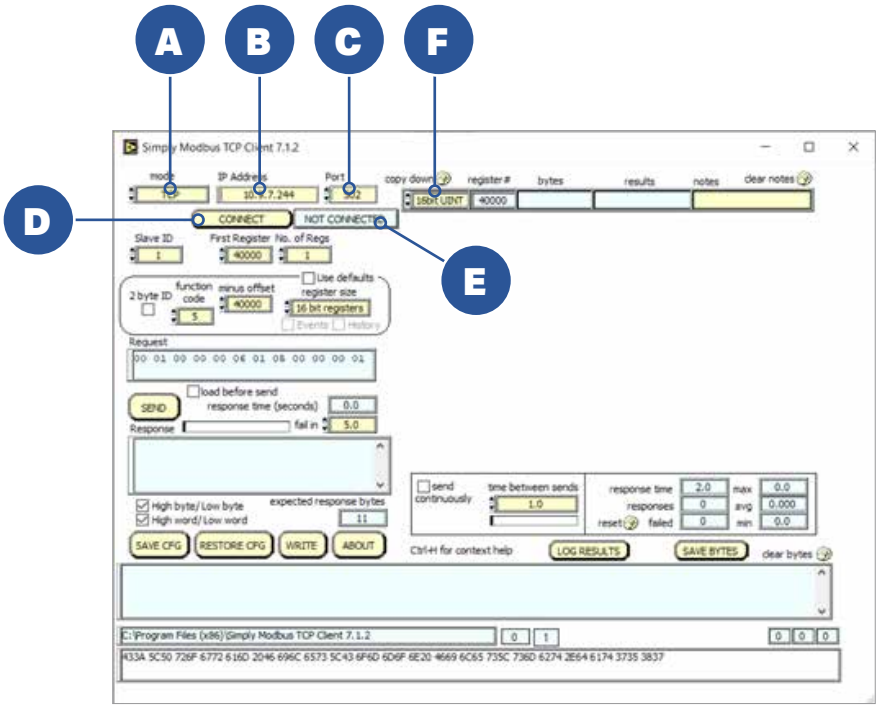


Figure 48.1. Download the Simply Modbus TCP Client software and then connect to the CDDP-A. Use the TCP mode, enter the CDDP-A's IP address, make sure the Port is 502, and then click on the Connect button. When the CDDP-A is connected, the Not Connected button with change to green and indicate Connected.

Using Simply Modbus TCP Client

As previously noted, the third piece of software to control the CDDP-A via an Ethernet connection is Simply Modbus, which can be downloaded at https://www.simplymodbus.ca/TCPclient.htm. The free edition will allow up to six messages before you will need to restart application as of when this users guide went to press.

SETUP A CONNECTION

To connect the CDDP-A to the Simply Modbus TCP Client software, refer to Figure 48.1 and follow these instructions:

- Set Mode (A) to TCP.
- Enter the CDDP-A's IP address (B).
- Make sure the Port (C) is 502, which is the default port value.
- Click on the Connect button (D). The Not Connected indicator (E) should change to Connected and turn green.

READING A COIL

To read from a coil, and with the CDDP-A connected, refer to Figure 49.1 and follow these instructions:

- Verify the Slave ID is 1.
- Verify the value of the First Coil address is 40000.

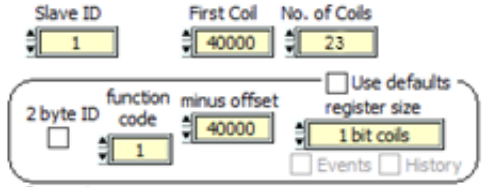


Figure 49.1.

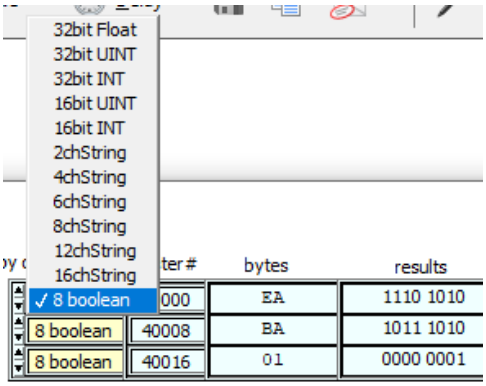


Figure 49.2.

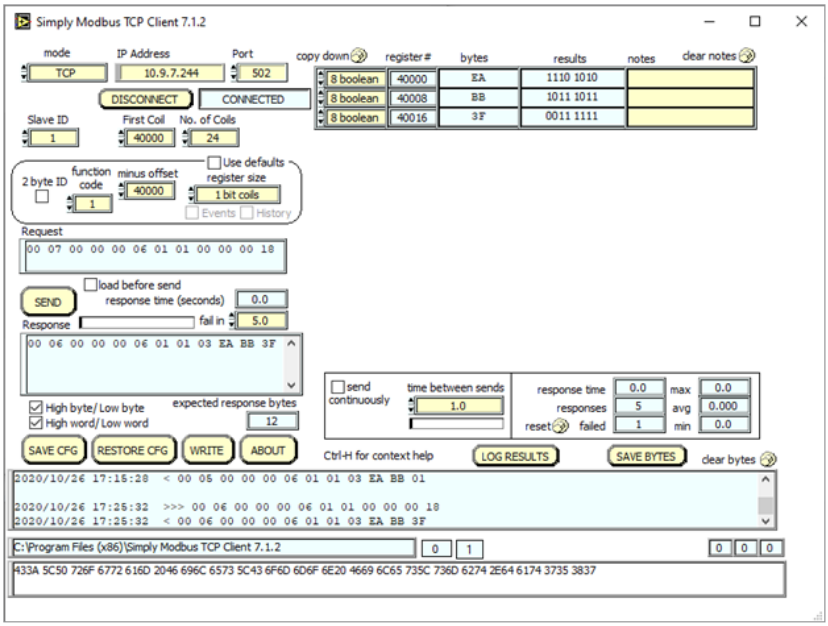


Figure 49.3.

- Set the No. of Coils to 23.
- Change Function code to 1.
- Change the Register Size to 1 bit coils.
- In the Copy Down cell (labeled as (F) in Figure 48.1), change the input to 8 boolean. See Figure 49.2.
- Click Send to send the instructions to the CDDP-A.

The code will appear as displayed in Figure 49.3. Notice in the row with register 40000 the results cell has 1110 1010, which represents the first eight coil states. The least significant bit is coil 0, so Pulse 1 Power Comparator Enable is Off "0b0". The next row has the next eight coil states and starts with register 40008 which is coil 8 Comparator Action after Pulse 1 and it is also Off "0b0". The next row starts with register 40016, coil 16, or Alarm – Trigger Enable.

Discrete inputs are accomplished in the same manner as described for coils; however, you must change the Function Code to 2.

READING A HOLDING REGISTER

To read from a holding register, and with the CDDP-A connected, refer to Figure 50.1 and follow these instruction:

- Change the No. of Reg to 36.
- Change Function Code" to 3.

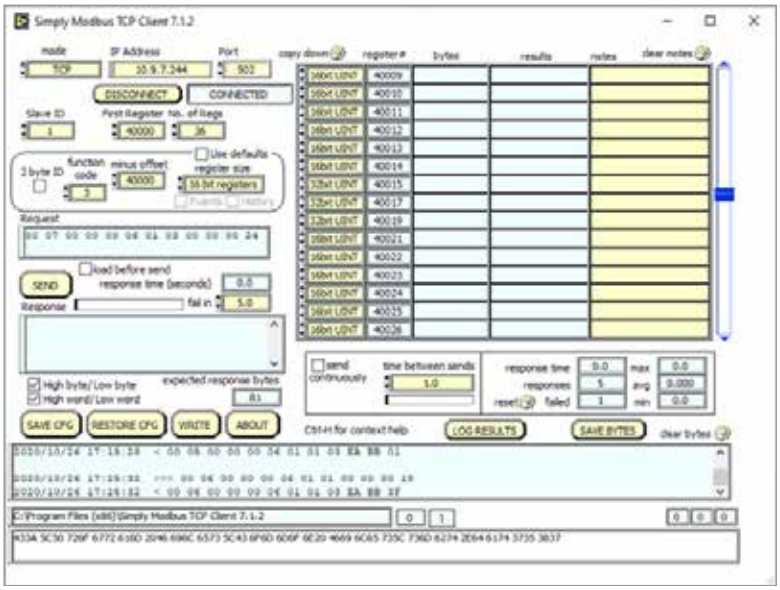


Figure 50.1. How the software inputs appear BEFORE you click on the Send button.

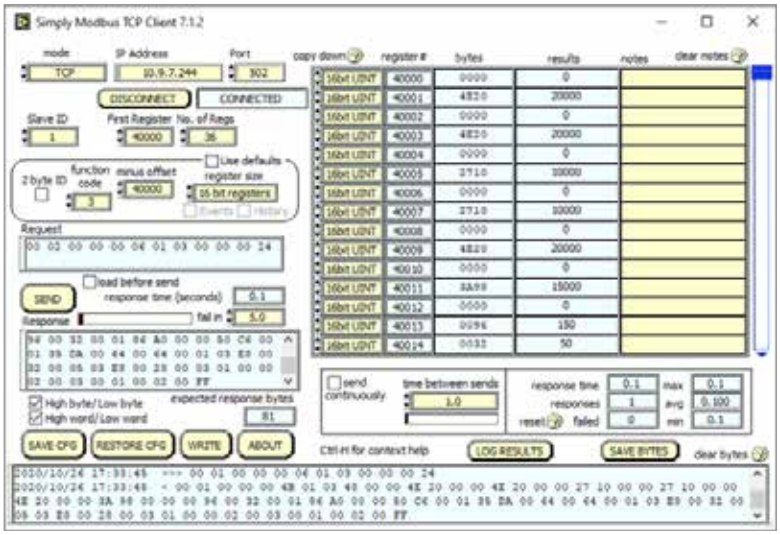


Figure 50.2. After you click on the Send button, the output spreadsheet reflects the instructions sent to the CDDP-A.

- Change Register Size to 16 bit registers.
- Go to register 15 on the output spreadsheet and change to 32bit UINT.
- Change register 17 and 19 to 32bit UINT as well. All other registers should be 16bit UINT.
- Click on the Send button.

Notice that the output spreadsheet reflects the instructions sent to the CDDP-A, as shown in Figure 50.2. At Register 40000 (which is the same as Holding Register 0x0000) the value is 0 which correlates to the Remote Schedule Select Mode being “Disabled”, as noted in the Holding Register Table on page 68.

If you scroll down to Register 40015 (or Holding Register 0x000F) you’ll see a value of 100000, which is 100,000 milliwatt seconds. The energy total is 100 WS.

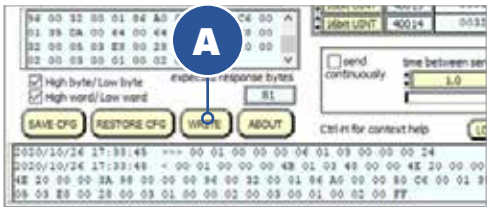


Figure 51.1.

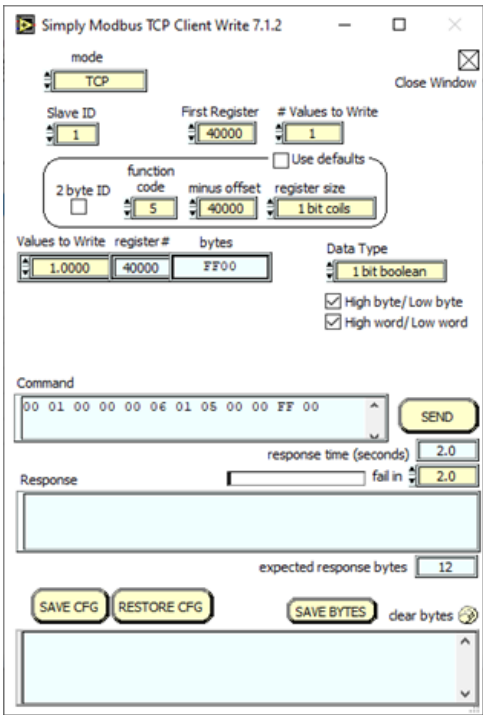


Figure 51.2.

WRITING TO A SINGLE COIL

To write to a single coil, follow these instructions:

- On the main screen click the Write button (A) near the bottom of the window as shown in Figure 51.1.
- A new window will appear. See Figure 49.2. In this new window, make sure Mode is set to TCP
- Set #Values to Write to 1.
- Change the function code to 5, with Register Size set to 1 bit coils.
- Change the Values to Write to 1.0000.
- Change the Data Type to 1 bit Boolean.
- Click the Send button to relay the instructions to the CDDP-A.

In this example, the Pulse 1 Power Comparator Enable state was changed to ON, which should be noted on the CDDP-A's screen.

If you change the values to Write to 0.0000 and click on the Send button, you'll change the state to OFF.

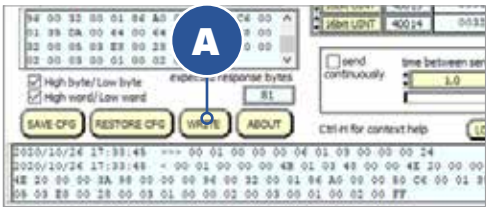


Figure 52.1.

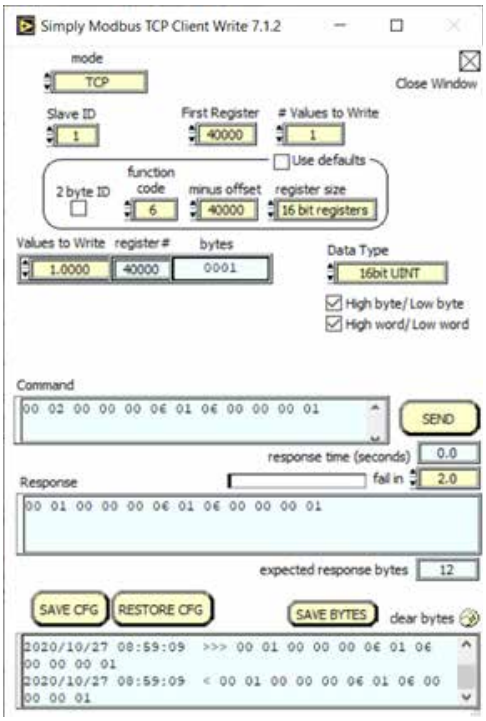


Figure 52.2.

WRITING TO A SINGLE REGISTER

To write to a single register, follow these instructions:

- On the main screen click the Write button (A) near the bottom of the window as shown in Figure 52.1.
- A new window will appear. See Figure 52.2. In this new window, make sure Mode is set to TCP.
- Set the function code to 6.
- Adjust the register size to 16 bit registers.
- Adjust the Values to Write to 1.000.
- Adjust the Data Type to 16bit UINT.
- Click on the Send button.

In this example, notice the response ends in 01. The CDDP-A will adjust the Remote Schedule Select Mode to 1 which is Basic.

If you change the values to write to 0.0000 and click on the Send button, the response ends in 00 and the remote schedule select mode on the CDDP-A is “OFF” or disabled.

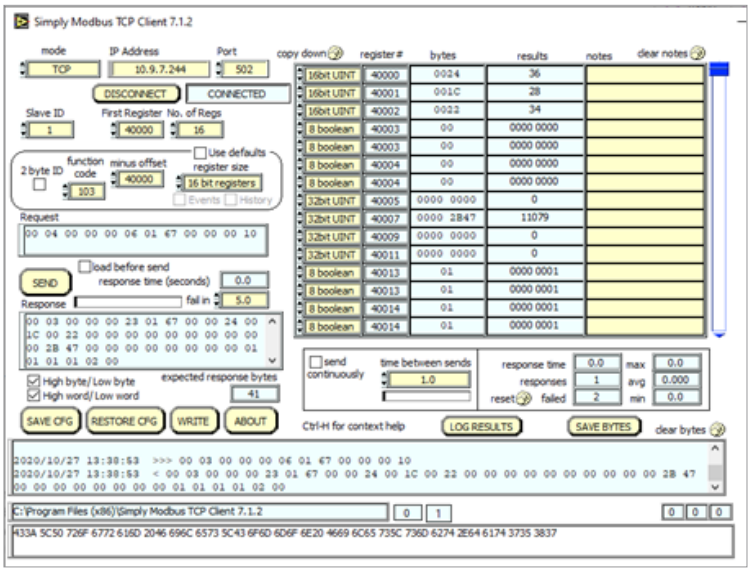


Figure 53.1.

RECEIVING A GENERAL PACKET

To receive a general packet, follow these instructions:

- On the main screen click the Write button (A) near the bottom of the window as shown in Figure 53.1.
- A new window will appear. See Figure 52.2. In this new window, make sure Mode is set to TCP.
- Set the function code to 103.
- Adjust the register size to 16 bit registers.
- In the output spreadsheet, change the rows in the first column in this order:

  16bit UINT

  16bit UINT

  16bit UINT

  8 boolean

  8 boolean

  8 boolean

  8 boolean

  32bit UINT

  32bit UINT

  32bit UINT

32bit UINT

8 boolean

8 boolean

8 boolean

8 boolean

8 boolean

8 boolean

- Click the Send button and note the results. You can compare with the general packet in Modbus documentation.

Note: The first three results are temperatures in Celsius.

Chapter 12: Back Panel Connector Details

In this chapter you'll find detailed information about the CDDP-A's back panel connectors. All DIN connections are displayed here as if viewed from the back panel. Refer to Appendix A for pinout configurations.

Ethernet. Plug an Ethernet cable into this port if you desire to control the CDDP-A with a PLC. See Chapter 11 for more information about connecting the CDDP-A to a computer via an Ethernet connection.

Accessory. Used to connect external accessories (Coming Soon).

PLC. Mates to SD-80LP.

E-Stop. Mates to SD-60LP.

WH Control. Mates to SD-40LP.

Primary Trigger. Mates to SD-50LP.

Secondary Trigger. Mates to SD-30LP.

Negative (-). Negative weld terminal. Connect weld cable using ¼-20 x ¾" bolt and nut. Make sure your total weld cable resistance is greater than or equal to 1 milliohm of resistance.

Positive (+). Positive weld terminal. Connect weld cable using ¼-20 x ¾" bolt and nut. Make sure your weld cable resistance is greater than or equal to 1 milliohm of resistance.

Fuse. 10A fuse rated for up to 250VAC, 90-250 VAC, 60Hz

Power Inlet. Plug wall power into this port. Can accept voltage from 90-250VAC at a frequency of 50/60Hz.

Appendix A: Connection Pin-Out Diagrams

Figure 56.1.PLC pin-Out

PLC Pin-Out

Refer to Figure 56.1.

1: GND/Shield

2: +12V Current Limited

3: PLC Input 1. Short this pin with Pin1 (GND) to trigger an action.

4: PLC Input 2. Short this pin with Pin1 (GND) to trigger an action.

5: Weld Ready. Pull this pin up to high (+12V) by connecting it with Pin 2 (+12V). Signal will go low (0V), when weld is ready.

6: Alarm. Pull this pin up to +12V by connecting it with Pin 2 (+12V). Signal will go low 0V, when alarm has occurred.

7: PLC Output 1. Pull this pin up to +12V by connecting it with Pin 2 (+12V). Signal will go low 0V, when this output has been enabled.

8: PLC Output 2. Pull this pin up to +12V by connecting it with Pin 2 (+12V). Signal will go low 0V, when this output has been enabled.

Note: If you choose to use the software E-STOP alarm as one of the PLC outputs on the 8 DIN PLC connector, realize that this signal will be a pulse that will last a minimum of 50 milliseconds.

E-STOP Pin-Out

Refer to Figure 57.1.

1: GND/Shield

2 & 3: Normally open, E-STOP enabled. Close circuit to disable E-STOP

Note: Pins 4 through 6 are unused.

Figure 57.1.E-STOP pin-out.

Weld Head Control Pin-Out

Refer to Figure 57.2.

1: GND/Shield

2: Weld Head Actuation 2. +12VDC(0.5A Max) is sent when weld head needs to actuate.

3: Weld Head Actuation 1. +12VDC(0.5A Max) is sent when weld head needs to actuate.

4: GND/Shield

Figure 57.2.Weld Head Control in-out.

Primary Trigger Pin-Out

Refer to Figure 57.3.

1: Variable Foot Pedal. Connect this to Pin5 (+12VDC) with a 10Kohm potentiometer.

2: Primary Trigger. Connect this to Pin3 (GND) when trigger is desired.

3: GND/Shield

4: Secondary Trigger. Connect this to Pin3 (GND) when trigger is desired.

5: +12VDC limited.

Figure 57.3.Primary Trigger pin-out.

Figure 58.1.Secondary Tirgger pin-out.

Secondary Trigger Pin-Out

Refer to Figure 58.1.

1: Not Connected

2: +12V

3: Secondary Trigger. Connect this to Pin 2(+12VDC) when trigger is desired.

Appendix B: Warnings and Alarms

If the CDDP-A experiences a problem a warning or alarm message will appear. Appendix B provides a list of all warnings/alarms, what they mean and how they may be resolved. If you need additional assistance, call or text +1 801-658-0015.

Warning	Solution
Comparator Failures in a Row	The number of failures allowed in a row has been met. Touch the Dismiss button and check weld settings, workpiece and setup.
Electrode Stuck	Should the electrode become stuck to the work piece, the CDDP-A will display this alarm. The alarm will disappear once the electrode is freed or if you touch the Dismiss button.
Emergency Stop Active	Should the CDDP-A encounter an unsafe state, the unit will stop all welding and display this alarm. Unsafe states may include the following: Internal communications error, voltage error on terminals, voltage error on capacitors, internal temperature over heating, or capacitors not charging. Call Sunstone's customer service team for immediate assistance.
Error Corrupt File	If the CDDP-A is unable to read a file, the unit will display this alarm and name the corrupted file. Touch on the Dismiss button and then try reloading a different file.
Error: Pulse 1 Comparator Fail	If you disable the "Continue on Failure" feature in the Comparator tab and a comparator for Pulse 1 fails, this warning will appear. Touch the Dismiss button. Examine the work piece. Make adjustments to the work piece or the weld parameters and continue operation.
Error: Roll Spot Mode	If the CDDP-A's capacitors are taking longer than normal to recharge while in Roll Spot Mode this alarm will appear. Contact Sunstone's customer service team for immediate assistance.

Warning	Solution
Failed to Connect to Server	If the CDDP-A is unable to connect to the Sunstone server in order to update its software and firmware, this alarm will appear. Touch the Dismiss button and then check all physical connections, software configuration settings on the CDDP-A, and verify the CDDP-A has access to the Internet. Then try reconnecting to the server again. If you encounter this problem again, call Sunstone's customer service team for immediate assistance.
File Transfer Failed	If you're transferring a file from a thumb drive to the CDDP-A and the transfer fails this alarm will appear. Touch on the Dismiss button. Verify the file you wish to transfer is readable and that the external media (thumb drive) is operating correctly. Try transferring the file again. Contact Sunstone's customer service team if the problem persists.
Firmware Update Failed	If the CDDP-A is attempting to update its firmware and that attempt fails, this alarm will appear. Touch the Dismiss button. Verify the CDDP-A has access to the Internet and try again. Contact Sunstone's customer service team if the problem persists.
Firmware Updated	If the CDDP-A successfully updates its firmware this alarm will appear. Touch the Okay button to return to normal operation.
Firmware Updating	While the CDDP-A is updating its firmware this warning will be displayed with a bar representing how much of the operation has been completed. When the update is completed a new warning will appear, "Firmware Updated." You will not be able to operate the CDDP-A during this process.
Hardware Issues with Welder	If the Power Supply Unit (PSU) or main circuit board is unable to communicate with the touchscreen interface (LCD), this alarm will appear. Restart the welder. If the message persists, contact Sunstone's customer service team for immediate assistance.
Not Enough Room on the USB Drive	If you are attempting to export a file from the CDDP-A to a USB drive (or other type of external media) and the size of the file exceeds the capacity of the USB drive this warning will appear. Try a larger USB drive or remove other files on the USB drive to create more room.
Pulse Not Enabled	If you try to enable a comparator for Pulse 1 but Pulse 1 has not been enabled, this warning will appear. To enable Pulse 1 touch "Enable Pulse 1". If you don't wish to enable Pulse 1 touch "Okay".
PSOC Update Failed	If an error occurs while the firmware is being updated this alarm will appear. Contact Sunstone's customer service team for immediate assistance.
Roll Spot Enabled	If you're using the CDDP-A in Roll Spot Mode and try to enable the comparator this warning will appear. The comparator feature is unavailable in Roll Spot Mode.

Warning	Solution
Temperature Alarm	If the CDDP-A's internal temperature exceeds the limit set by the operator this alarm will appear. Tolerances can be adjusted in the Alarms screen; however, it recommended that you first determine if operation should cease allowing the unit to cool.
Trigger in Pause	If the CDDP-A's weld state is off and the unit receives a trigger, this warning will appear letting you know that despite the trigger the weld head did not actuate. Touch the Dismiss button. If you wish to actuate a weld, change the weld state to on.
Trigger Input Error	If the CDDP-A receives a trigger signal from an unselected source this warning will appear as a protection mechanism designed to prevent accidental triggers. Touch the Dismiss button. Inspect all cables, weld settings, and the work area before continuing operation.
Weld Count Preset Limit	Once the number of welds reaches the limit defined by the operator this warning will appear. To continue operating touch the Dismiss button.
Weld Head Trigger Timeout	This warning will appear letting you know that despite a trigger the weld head did not actuate within the expected time. Touch the Dismiss button. Verify weld settings, the electrode path, cables, and the work piece and the try again. If the problem persists contact Sunstone's customer service team for immediate assistance.
Welder Cooled	If the welder becomes overheated, wait for CDDP-A to cool and display this message. Touch the Dismiss button, verify you operating under safe conditions, and then continue. Feel free to contact Sunstone's customer service team if the CDDP-A continues to overheat.
Welder is Overheated	If the CDDP-A exceeds safe operating temperatures this warning will appear. The CDDP-A will enter an emergency stop active mode and you will not be able to continue operation until the unit cools. If you press the Dismiss button the welder will not function until the unit has cooled. If you do nothing, this message will automatically close when the welder reaches a safe operating temperature. Check weld settings, the work piece, and the work space and verify you operating under safe circumstances before continuing operation.

NOTE: This unit may experience communication problems, including problems between the user interface and the internal hardware. These problems are rare, but they will occasionally occur when the unit is used in an electrically noisy environment. If communication problems do arise, a power cycle will usually resolve this problem. Simply turn the machine off, wait 30 seconds, and power the machine back up. If the error persists, the unit may need to be sent in for servicing.

Appendix C: Modbus Data Tables

Reference these tables when sending/receiving messages to/from the CDDP-A via an ethernet connection using Modbus software.

SUPPORTED FUNCTION CODES

Funtion Code (dec)	Funtion Code (hex)	Name	Read/Write
1	0x01	Read Coils	
2	0x02	Read Discrete Inputes	
3	0x03	Read Holding Registers	
4	0x04	Read Input Registers	
5	0x05	Write Single Coil	
6	0x06	Write Single Register	
15	0x0F	Write Multiple Coils	
16	0x10	Write Multiple Registers	
20	0x14	Read File Record	
22	0x16	Mask Write Register	
23	0x17	Read/Write Mulitple Registers	
65	0x41	Modbus E-Stop Set	Write
66	0x42	Modbus E-Stop Clear	Write
67	0x43	Weld	Write
68	0x44	Schedule Weld Data	Read/Write
69	0x45	Schedule Extra Weld Data	Read/Write
70	0x46	Comparator	Read/Write
71	0x47	Alarm Settings	Read/Write
72	0x48	Basic PLC Settings	Read/Write
100	0x64	Comparator Failure and Weld Count	Read
101	0x65	RSS Mode	Read/Write
102	0x66	System Info	Read

Funtion Code (dec)	Funtion Code (hex)	Name	Read/Write
103	0x67	General Info	Read
104	0x68	Previous Weld Results	Read
105	0x69	Alarm States	Read
106	0x6A	Waveform Report General	Read
107	0x6B	Emergency Stop State	Read
108	0x6C	Basic PLC States	Read
109	0x6D	RSS States	Read
110	0x6E	Network info	Read

DATA STRUCTURES

Data Structures	Size	Count	Type
Coil	1-Bit	23	Read/Write
Discrete Input	1-Bit	25	Read
Holding Register	16-Bit	33	Read/Write
Input Register	16-bit	82	Read
File Record		4	Read

COILS

Index (dec)	Index (hex)	Coil
0	0x0000	Pulse 1 Power Comparator Enable
1	0x0001	Pulse 2 Power Comparator Enable
2	0x0002	Pulse 1 Current Comparator Enable
3	0x0003	Pulse 2 Current Comparator Enable
4	0x0004	Pulse 1 Voltage Comparator Enable
5	0x0005	Pulse 1 Voltage Comparator Enable
6	0x0006	Pluse 1 Enable
7	0x0007	Pulse 2 Enable
8	0x0008	Comparator Action after Pulse 1
9	0x0009	Roll Spot Enabled
10	0x000A	Alarm - Temperature Enable
11	0x000B	Alarm - Comparator Enable
12	0x000C	Alarm - Part Check Enable

Index (dec)	Index (hex)	Coil
13	0x000D	Alarm - Electrode Stuck Enable
14	0x000E	Alarm - Weld Counter Enable
15	0x000F	Alarm - Trigger Enable
16	0x0010	Alarm - Wrong Trigger Enable
17	0x0011	Alarm - Invalid Selection Enable
18	0x0012	Warning - Temperature Enable
19	0x0013	Warning - Comparator Enable
20	0x0014	Warning - Weld Counter Enable
21	0x0015	Weld Triggered
22	0x0016	Modbus E-Stop

DISCRETE INPUTS

Index	Discrete Input	Note
0	PLC Pin 3 - State	Active Low
1	PLC Pin 4 - State	Active Low
2	PLC Pin 5 - State	Active Low
3	PLC Pin 6 - State	Active Low
4	PLC Pin 7 - State	Active Low
5	PLC Pin 8 - State	Active Low
6	Error - Heartbeat	
7	Error - Overtemp	
8	Error - Terminal Voltage	
9	Error - Capacitors Overvoltage	
10	Error - Capacitors not Charging	
11	Alarm - Temperature State	
12	Alarm - Comparator Failures in a Row State	
13	Alarm - Electrode Stuck State	
14	Alarm - Weld Counter Preset Limit State	
15	Alarm - Remote Schedule Selection Invalid State	
16	Alarm - Trigger in no Weld State State	
17	Alarm - Wrong Trigger Detected State	
18	Alarm - Part Check Failed State	
19	Warning - Comparator Failures in a Row State	
20	Warning - Temperature State	
21	Warning - Weld Counter Preset Limit State	
22	Previous Weld Results P1 Enabled	

Index	Discrete Input	Note
23	Previous Weld Results P2 Enabled	
24	E-Stop State	

HOLDING REGISTERS

Index	Holding Register	Length	Minimum	Maximum	Note
0	Remote Schedule Select Mode	1	*See Table*	*See Table*	
1	Pulse 1 Power Comparator Limit Upper	1	0x0000	0x4E20	daW
2	Pulse 1 Power Comparator Limit Lower	1	0x0000	0x4E20	daW
3	Pulse 2 Power Comparator Limit Upper	1	0x0000	0x4E20	daW
4	Pulse 2 Power Comparator Limit Lower	1	0x0000	0x4E20	daW
5	Pulse 1 Current Comparator Limit Upper	1	0x0000	0x2710	A
6	Pulse 1 Current Comparator Limit Lower	1	0x0000	0x2710	A
7	Pulse 2 Current Comparator Limit Upper	1	0x0000	0x2710	A
8	Pulse 2 Current Comparator Limit Lower	1	0x0000	0x2710	A
9	Pulse 1 Voltage Comparator Limit Upper	1	0x0000	0x4E20	mV
10	Pulse 1 Voltage Comparator Limit Lower	1	0x0000	0x4E20	mV
11	Pulse 2 Voltage Comparator Limit Upper	1	0x0000	0x4E20	mV
12	Pulse 2 Voltage Comparator Limit Lower	1	0x0000	0x4E20	mV
13	Weld Head Settings Squeeze Delay	1	0x0096	0x2710	mV
14	Weld Head Settings Hold Delay	1	0x0001	0x2710	ms
15	Energy Total	2	0x0000015E	0x00030D40 (200000), 0x00061A80 (400000), 0x000927C0 (600000), 0x00124F80 (1200000)	mWs
17	Energy Pulse 1	2	0x00000064	0x0000EA60 (200000), 0x0001D4C0 (400000), 0x0002BF20 (600000), 0x00057E40 (1200000)	mWs

Index	Holding Register	Length	Minimum	Maximum	Note
19	Energy Pulse 2	2	0x00000064	0x00030D40 (200000), 0x00061A80 (400000), 0x000927C0 (600000), 0x00124F80 (1200000)	mWs
21	Time Between Pulses	1	0x0001	0x0064	ms
22	Pre Weld Delay	1	0x0001	0x2710	ms
23	Weld Head Control Type	1	*See Table*	*See Table*	
24	Welds Per Second	1	0x0032	0x03E8	Welds per hecto-second
25	Alarm Temperature Value	1	0x0000	0x0064	C
26	Alarm Comparator Value	1	0x0001	0x0019	
27	Alarm Weld Counter Value	1	0x0001	0x4E20	
28	Warning Temperature Value	1	0x0000	0x0064	C
29	Warning Comparator Value	1	0x0001	0x0019	
30	Warning Weld Counter Value	1	0x0001	0x4E20	
31	PLC Pin 3 - Assignment	1	*See Table*	*See Table*	PLC Input
32	PLC Pin 4 - Assignment	1	*See Table*	*See Table*	PLC Input
33	PLC Pin 7 - Assignment	1	*See Table*	*See Table*	PLC Output
34	PLC Pin 8 - Assignment	1	*See Table*	*See Table*	PLC Output
35	Current Remote Schedule Selection	1	0x0000	0x007F	When no selection is wanted, set to 0x00FF

HOLDING REGISTERS: REMOTE SCHEDULE SELECT MODES

Remote Schedule Select Mode	Value
Disabled	0x0000
Basic	0x0001
Ethernet	0x0002

HOLDING REGISTERS: WELD HEAD CONTROL TYPES

Weld Head Control Type	Value
Fully Automatic	0x0000
Automatic with Timing	0x0001
Automatic with Trigger	0x0002

HOLDING REGISTERS: PLC OUTPUT PIN ASSIGNMENTS

PLC Output Pin Assignment	Value
Unassigned	0x0000
Weld Ready	0x0001
Weld Good	0x0002
Weld Not Good	0x0003
Emergency Stop	0x0004
Alarm - Any	0x0005
Alarm - Temperature	0x0006
Alarm - Comparator Failures in a Row	0x0007
Alarm - Electrode Stuck	0x0008
Alarm - Weld Counter Preset Limit	0x0009
Alarm - Remote Schedule Selection Invalid	0x000A
Alarm - Part Check Failed	0x000B
Alarm - Trigger in no Weld State	0x000C
Alarm - Wrong Trigger Detected	0x000D
Warning - Any	0x000E
Warning - Temperature	0x000F
Warning - Comparator Failures in a Row	0x0010
Warning - Weld Counter Preset Limit	0x0011

HOLDING REGISTERS: PLC INPUT PIN ASSIGNMENTS

PLC Output Pin Assignment	Value
Unassigned	0x0000
Primary Trigger	0x0001
Secondary Trigger	0x0002
Reset Weld Count	0x0003
Lock Out	0x0004
Remote Schedule Select	0x0005

INPUT REGISTERS

Index	Input Register	Length	Notes
0	PLC Pin 5 - Assignment	1	PLC Output
1	PLC Pin 6 - Assignment	1	PLC Output
2	Foot Pedal Analog	1	
3	Charge Temperature	1	C
4	Weld Temperature	1	C
5	Bleed Temperature	1	C
6	Previous Weld Peak Voltage P1	1	mV
7	Previous Weld Peak Voltage P2	1	mV
8	Previous Weld Peak Current P1	1	A
9	Previous Weld Peak Current P2	1	A
10	Previous Weld Peak Power P1	1	daW
11	Previous Weld Peak Power P2	1	daW
12	Previous Weld Comparator Result	1	
13	Previous Weld Comparator Result Power P1	1	
14	Previous Weld Comparator Result Power P2	1	
15	Previous Weld Comparator Result Voltage P1	1	
16	Previous Weld Comparator Result Voltage P2	1	
17	Previous Weld Comparator Result Current P1	1	
18	Previous Weld Comparator Result Current P2	1	
19	MAC[0]	1	
20	MAC[1]	1	
21	MAC[2]	1	
22	MAC[3]	1	
23	MAC[4]	1	
24	MAC[5]	1	
25	IP[0]	1	
26	IP[1]	1	
27	IP[2]	1	
28	IP[3]	1	
29	Subnet Mask[0]	1	
30	Subnet Mask[1]	1	
31	Subnet Mask[2]	1	
32	Subnet Mask[3]	1	
33	Gateway[0]	1	
34	Gateway[1]	1	
35	Gateway[2]	1	

Index	Input Register	Length	Notes
36	Gateway[3]	1	
37	Alternative Port	1	
38	Network Timeout	1	
39	Whitelist IP 1[0]	1	
40	Whitelist IP 1[1]	1	
41	Whitelist IP 1[2]	1	
42	Whitelist IP 1[3]	1	
43	Whitelist IP 2[0]	1	
44	Whitelist IP 2[1]	1	
45	Whitelist IP 2[2]	1	
46	Whitelist IP 2[3]	1	
47	Whitelist IP 3[0]	1	
48	Whitelist IP 3[1]	1	
49	Whitelist IP 3[2]	1	
50	Whitelist IP 3[3]	1	
51	Whitelist IP 4[0]	1	
52	Whitelist IP 4[1]	1	
53	Whitelist IP 4[2]	1	
54	Whitelist IP 4[3]	1	
55	Whitelist IP 5[0]	1	
56	Whitelist IP 5[1]	1	
57	Whitelist IP 5[2]	1	
58	Whitelist IP 5[3]	1	
59	Whitelist IP 6[0]	1	
60	Whitelist IP 6[1]	1	
61	Whitelist IP 6[2]	1	
62	Whitelist IP 6[3]	1	
63	Priority IP 1[0]	1	
64	Priority IP 1[1]	1	
65	Priority IP 1[2]	1	
66	Priority IP 1[3]	1	
67	Priority IP 2[0]	1	
68	Priority IP 2[1]	1	
69	Priority IP 2[2]	1	
70	Priority IP 2[3]	1	
71	Waveform Report Total Samples	1	
72	Waveform Report P1 Samples	1	
73	Waveform Report P2 Samples	1	

Index	Input Register	Length	Notes
74	Waveform Report Starting Voltage	1	mV
75	Waveform Report P1 Start Time	1	
76	Waveform Report P1 End Time	1	
77	Waveform Report P2 Start Time	1	
78	Waveform Report P2 End Time	1	
79	Waveform Report Total Duration	1	
80	Waveform Report P1 Duration	1	
81	Waveform Report P2 Duration	1	

COMPARATOR RESULTS

Comparator Result (hex)	Name
0x0000	Weld Good
0x0001	Weld Bad
0x0002	Weld Bad - E-Stop
0x0003	Part Check Failed

FILE RECORDS

File Number	File Record	Length
0x0001	Previous Weld Record Time (1 Count = 0.05 ms)	0x01F4
0x0002	Previous Weld Record Voltage (mV)	0x01F4
0x0003	Previous Weld Record Current (A)	0x01F4
0x0004	Previous Weld Record Power (daW)	0x01F4

File Records are an array of data that consists of the raw weld waveform data of the previous weld. File Records can each have up to 0x01F4 (500) data values. An example of the data table follows:

FILE RECORDS: RAW DATA (EXAMPLE)

Time (ms)	Voltage (V)	Current (A)	Power (W)
0.45	0	0	0
0.6	0.731	0	0
0.7	7.012	99	690
0.85	7.462	643	4790
0.95	7.368	1208	8900
...	...	...	...

FILE RECORDS: READ FILE RECORD (20 / 0x14)

Data Type	Data Size	Data Input
Server Address	1 Byte	0xFF
Function Code	1 Byte	0x14
Byte Count	1 Byte	0x07 – 0xF5
Sub Request x: Reference Type	1 Byte	0x06
Sub Request x: File Number	2 Byte	0x0001 – 0x0004
Sub Request x: Record Number	2 Byte	0x0000 – 0x01F4
Sub Request x: Record Length	2 Byte	N
Sub Request x+1…		

FILE RECORDS: RESPONSE TO "READ FILE RECORD"

Data Type	Data Size	Data Output
Server Address	1 Byte	0xFF
Function Code	1 Byte	0x14
Response Length	1 Byte	0x04-0xF5
Sub Request x: Request Length	1 Byte	0x03-0xF5
Sub Request x: Reference Type	1 Byte	0x06
Sub Request x: Data	N x 2 Byte	
Sub Request x+1…		

FILE RECORDS: READ FIRST 4 TIME VALUES

Data Type	Data Size	Data Input
Server Address	1 Byte	0xFF
Function Code	1 Byte	0x14
Response Length	1 Byte	0x04-0xF5
Sub Request x: Request Length	1 Byte	0x03-0xF5
Sub Request x: Reference Type	1 Byte	0x06
Sub Request x: Data	N x 2 Byte	
Sub Request x+1…		

FILE RECORDS: RESPONSE TO "FIRST 4 TIME VALUES"

Data Type	Data Size	Data Output	Data Value
Server Address	1 Byte	0xFF	
Function Code	1 Byte	0x14	
Response Length	1 Byte	0x0A	
Request Length	1 Byte	0x09	
Reference Type	1 Byte	0x06	
File Record 1 - Data [0]	2 Byte	0x0009	0.45ms (9 x 0.05)
File Record 1 - Data [1]	2 Byte	0x000C	0.6ms
File Record 1 - Data [2]	2 Byte	0x000F	0.75ms
File Record 1 - Data [3]	2 Byte	0x0011	0.85ms

FILE RECORDS: READ FIRST 4 TIME VALUES AND FIRST 4 VOLTAGE VALUES

Data Type	Data Size	Data Input
Server Address	1 Byte	0xFF
Function Code	1 Byte	0x14
Byte Count	1 Byte	0x0E
Sub Request 1: Reference Type	1 Byte	0x06
Sub Request 1: File Number	2 Byte	0x0001
Sub Request 1: Record Number	2 Byte	0x0000
Sub Request 1: Record Length	2 Byte	0x0004
Sub Request 2: Reference Type	1 Byte	0x06
Sub Request 2: File Number	2 Byte	0x0002
Sub Request 2: Record Number	2 Byte	0x0000
Sub Request 2: Record Length	2 Byte	0x0004

FILE RECORDS: RESPONSE TO "FIRST 4 TIME VALUES AND FIRST 4 VOLTAGE VALUES"

Data Type	Data Size	Data Output	Data Value
Server Address	1 Byte	0xFF	
Function Code	1 Byte	0x14	
Response Length	1 Byte	0x14	
Sub Request 1: Request Length	1 Byte	0x09	
Sub Request 1: Reference Type	1 Byte	0x06	
Sub Request 1: File Record 1 - Data [0]	2 Byte	0x0009	0.45ms (9 x 0.05)
Sub Request 1: File Record 1 - Data [1]	2 Byte	0x000C	0.6ms
Sub Request 1: File Record 1 - Data [2]	2 Byte	0x000F	0.75ms
Sub Request 1: File Record 1 - Data [3]	2 Byte	0x0011	0.85ms
Sub Request 2: Request Length	1 Byte	0x09	
Sub Request 2: Reference Type	1 Byte	0x06	
Sub Request 2: File Record 2 - Data [0]	2 Byte	0x0000	0mV
Sub Request 2: File Record 2 - Data [1]	2 Byte	0x0614	1,556mV=1.556V
Sub Request 2: File Record 2 - Data [2]	2 Byte	0x1AF3	6,899mV=6.899V
Sub Request 2: File Record 2 - Data [3]	2 Byte	0x1C45	7,237mV=7.237V

CUSTOM FUNCTIONS

- **Modbus E-Stop Set:** Does not require any data.
- **Modbus E-Stop Clear:** Does not require any data.
- **Weld:** Does not require any data.

CUSTOM FUNCTIONS: SCHEDULE WELD DATA (8 X 16 BIT REGISTERS)

Byte	0	1	2	3	4	5	6	7
Name	Total Energy (mWs)				Pulse 1 Enabled	Pulse 2 Enabled	Pulse 1 Energy (mWs) [3:2]	
Type	uint32				bool	bool	uint32	

Byte	8	9	10	11	12	13	14	15
Name	Pulse 1 Energy (mWs) [1:0]		Pulse 2 Energy (mWs)				Time Between Pulses	Pre Weld Delay (ms) [1]
Type	uint32		uint32				uint8	uint16

Byte	16
Name	Pre Weld Delay (ms) [0]
Type	uint16

CUSTOM FUNCTIONS: SCHEDULE EXTRA WELD DATA (6 X 16 BIT REGISTERS)

Byte	0	1	2	3	4	5	6	7
Name	Enable Weld Head Use	Weld Head Control Type	Squeeze Delay (ms)				Hold Delay (ms)[3:2]	
Type	bool		uint32				uint32	

Byte	8	9	10	11	12
Name	Hold Delay (ms)[1:0]		Roll Spot Enabled	Roll Spot in Between Delay (ms	
Type	uint32		bool	uint16	

CUSTOM FUNCTIONS: COMPARATOR (28 X 16 BIT REGISTERS)

Byte	0	1	2	3	4	5	6	7
Name	Comparator - Pulse 1 - Power - Enabled	Comparator - Pulse 1 - Power - Upper Limit (unit)				Comparator - Pulse 1 - Power - Lower Limit (unit)[3:1]		
Type	bool	uint32				uint32		

Byte	8	9	10	11	12	13	14	15
Name	Comparator - Pulse 1 - Power - Lower Limit (unit)[0]	Comparator - Pulse 1 - Current - Enabled	Comparator - Pulse 1 - Current - Upper Limit (A)				Comparator - Pulse 1 - Current - Lower Limit (A)[3:2]	
Type	uint32	bool	uint32				uint32	

Byte	16	17	18	19	20	21	22	23
Name	Comparator - Pulse 1 - Current - Lower Limit (A)[1:0]		Comparator - Pulse 1 - Voltage - Enabled	Comparator - Pulse 1 - Voltage - Upper Limit (mV)				Comparator - Pulse 1 - Voltage - Lower Limit (mV)[3]
Type	uint32		bool	uint32				uint32

Byte	24	25	26	27	28	29	30	31
Name	Comparator - Pulse 1 - Voltage - Lower Limit (mV)[2:0]			Comparator - Pulse 2 - Power - Enabled	Comparator - Pulse 2 - Power - Upper Limit (unit)			
Type	uint32			bool	uint32			

Byte	32	33	34	35	36	37	38	39
Name	Comparator - Pulse 2 - Power - Lower Limit (unit)				Comparator - Pulse 2 - Current - Enabled	Comparator - Pulse 2 - Current - Upper Limit (A)[3:1]		
Type	uint32				bool	uint32		

Byte	40	41	42	43	44	45	46	47
Name	Comparator - Pulse 2 - Current - Upper Limit (A)[0]	Comparator - Pulse 2 - Current - Lower Limit (A)				Comparator - Pulse 2 - Voltage - Enabled	Comparator - Pulse 2 - Voltage - Upper Limit (mV)[3:2]	
Type	uint32	uint32				bool	uint32	

Byte	48	49	50	51	52	53	54
Name	Comparator - Pulse 2 - Voltage - Upper Limit (mV)[1:0]		Comparator - Pulse 2 - Voltage - Lower Limit (mV)				Comparator - Continue Welding after Failed Pulse 1 Comparator
Type	uint32		uint32				bool

CUSTOM FUNCTIONS: ALARM SETTINGS (12 X 16 BIT REGISTERS)

Byte	0	1	2	3	4	5	6	7
Name	Temperature Alarm - Enabled	Comparator Alarm - Enabled	Electrode Stuck Alarm - Enabled	Weld Counter Alarm - Enabled	Invalid Selection Alarm - Enabled	Temperature Warning - Enabled	Comparator Warning - Enabled	Part Check Alarm - Enabled
Type	bool	bool	bool	bool	bool	bool	bool	bool

Byte	8	9	10	11	12	13	14	15
Name	Weld Counter Warning - Enabled	Trigger Alarm - Enabled	Wrong Trigger Alarm - Enabled	Temperature Alarm - Value		Comparator Alarm - Value		Weld Counter Alarm - Value[1]
Type	bool	bool	bool	uint16		uint16		uint16

Byte	16	17	18	19	20	21	22
Name	Weld Counter Alarm - Value[0]	Temperature Warning - Value		Comparator Warning - Value		Weld Counter Warning - Value	
Type	uint16	uint16		uint16		uint16	

CUSTOM FUNCTIONS: BASIC PLC SETTINGS (3 X 16 BIT REGISTERS)

Byte	0	1	2	3	4	5
Name	PLC Pin 3	PLC Pin 4	PLC Pin 5	PLC Pin 6	PLC Pin 7	PLC Pin 8
Type	PLC Input Assignment	PLC Input Assignment	PLC Output Assignment (Constant)	PLC Output Assignment (Constant)	PLC Output Assignment	PLC Output Assignment

Refer to “PLC Output Pin Assignment” and “PLC Input Pin Assignment”

COMPARATOR FAILURE AND WELD COUNT (4 X 16 BIT REGISTERS)

Byte	0	1	2	3	4	5	7	8
Name	Weld Count				Comparator Fail Count			
Type	uint32				uint32			

CUSTOM FUNCTIONS: RSS MODE (1 X BIT COIL)

Byte	0
Name	RSS Mode
Type	uint8

CUSTOM FUNCTIONS: GENERAL INFO (16 X 16 BIT REGISTERS)

Byte	0	1	2	3	4	5	7	8
Name	Charge Temperature		Weld Temperature		Bleed Temperature		Primary Trigger State	Secondary 5 Din Trigger State
Type	uint16		uint16		uint16		bool	bool

Byte	8	9	10	11	12	13	14	15
Name	Secondary 3 Din Trigger State	Weld Head Trigger State	Analog Foot Pedal Voltage				Capacitor Voltage (mV)[3:2]	
Type	bool	bool	uint32				uint32	

Byte	16	17	18	19	20	21	22	23
Name	Capacitor Voltage (mV)[1:0]		Terminal Voltage (mV)				Terminal Current (A) [3:2]	
Type	uint32		uint32				uint32	

Byte	24	25	26	27	28	29	30	31
Name	Terminal Current (A) [1:0]		Weld Task Current State	Charge Task Current State	Weld On State	Charge is Good Enough for Weld	PLC Set to Lock	PLC Input Reset Weld Count
Type	uint32		Weld Task State	Charge Task State	bool	bool	Lock State	bool

CUSTOM FUNCTIONS: GENERAL INFO: WELD TASK STATES

Weld Task State (hex)	Name
0x0000	Invalid
0x0001	Idle
0x0002	Pre-Weld
0x0003	Weld Head On
0x0004	Squeeze Delay
0x0005	Welder Overheated
0x0006	Part Check
0x0007	Weld P1
0x0008	In-between Pulses
0x0009	Weld P2
0x000A	Reporting
0x000B	Hold Delay
0x000C	Weld Head Off
0x000D	Roll Spot - In-between Welds
0x000E	Roll Spot - Waiting on Charge
0x000F	Finalize

CUSTOM FUNCTIONS: GENERAL INFO: CHARGE TASK STATES

Charge Task State (hex)	Name
0x0000	Invalid
0x0001	Charged
0x0002	Charging
0x0003	Draining
0x0004	Drained

CUSTOM FUNCTIONS: GENERAL INFO: LOCK STATES

Charge Task State (hex)	Name
0x0000	Unlocked
0x0001	Locked
0x0002	Lock Disabled

CUSTOM FUNCTIONS: PREVIOUS WELD RESULTS (17 X 16 BIT REGISTERS)

Byte	0	1	2	3	4	5	6	7
Name	Roll Spot Enabled	Part Check Passed	Comparator - Result	Comparator - Pulse 1 - Power - Result	Comparator - Pulse 2 - Power - Result	Comparator - Pulse 1 - Current - Result	Comparator - Pulse 2 - Current - Result	Comparator - Pulse 1 - Voltage - Result
Type	bool	bool	Comparator Result	Comparator Result	Comparator Result	Comparator Result	Comparator Result	Comparator Result

Byte	8	9	10	11	12	13	14	15
Name	Comparator - Pulse 2 - Voltage - Result	Pulse 1 Enabled	Pulse 2 Enabled	Pulse 1 Peak Current (A)				Pulse 2 Peak Current (A)[3]
Type	Comparator Result	bool	bool	uint32				uint32

Byte	16	17	18	19	20	21	22	23
Name	Pulse 2 Peak Current (A)[2:0]			Pulse 1 Peak Voltage (mV)				Pulse 2 Peak Voltage (mV)[3]
Type	uint32			uint32				uint32

Byte	24	25	26	27	28	29	30	31
Name	Pulse 2 Peak Voltage (mV)[2:0]			Pulse 1 Peak Power (10s of W)				Pulse 2 Peak Power (10s of W)[3]
Type	uint32			uint32				uint32

Byte	32	33	34
Name	Pulse 2 Peak Power (10s of W)[2:0]		
Type	uint32		

CUSTOM FUNCTIONS: 92/4

.ALARM STATES (5 X 16 BIT REGISTERS)

Byte	0	1	2	3	4	5	6	7
Name	Tempera-ture Alarm - State	Compara-tor Alarm - State	Electrode Stuck Alarm - State	Weld Counter Alarm - State	Part Check Alarm - State	Trigger Alarm - State	Wrong Trigger Alarm - State	Tempera-ture Warn-ing - State
Type	bool	bool	bool	bool	bool	bool	bool	bool

Byte	8	9
Name	Compara-tor Warning - State	Weld Counter Warning - State
Type	bool	bool

WAVEFORM REPORT GENERAL (11 X 16 BIT REGISTERS)

Byte	0	1	2	3	4	5	6	7
Name	Total Samples		P1 State Index	P2 State Index	Starting Voltage (mV)			
Type	uint16		uint8	uint8	uint32			

Byte	8	9	10	11	12	13	14	15
Name	Time - Pulse 1 - Start		Time - Pulse 1 - Finish		Time - Pulse 2 - Start		Time - Pulse 2 - Finish	
Type	uint16		uint16		uint16		uint16	

Byte	16	17	18	19	20	21
Name	Total Duration		Pulse 1 - Duration		Pulse 2 - Duration	
Type	uint16		uint16		uint16	

EMERGENCY STOP STATES (7 X 8 BIT REGISTERS)

Byte	0	1	2	3	4	5	6
Name	Hardware E-Stop	Error - Heartbeat	Error - Overtemp	Error - Terminal Voltage	Error - Capacitor Overvoltage	Error - Capacitors not Charging	Modbus E-Stop
Type	bool	bool	bool	bool	bool	bool	bool

BASIC PLC STATES (3 X 16 BIT REGISTERS)

Byte	0	1	2	3	4	5
Name	PLC Pin 3 - State	PLC Pin 4 - State	PLC Pin 5 - State	PLC Pin 6 - State	PLC Pin 7 - State	PLC Pin 8 - State
Type	bool	bool	bool	bool	bool	bool

RSS STATES (1 X 8 BIT COIL)

Byte	0
Name	Current RSS Value
Type	uint8

NETWORK INFO (20 X 16 BIT REGISTERS)

Byte	0	1	2	3	4	5	6	7
Name	IP[3]	IP[2]	IP[1]	IP[0]	Subnet Mask[3]	Subnet Mask[2]	Subnet Mask[1]	Subnet Mask[0]
Type	uint8	uint8	uint8	uint8	uint8	uint8	uint8	uint8

Byte	8	9	10	11	12	13	14	15
Name	Gateway[3]	Gateway[2]	Gate-way[1]	Gate-way[0]	Alterna-tive Port	Priority IP 1[3]	Priority IP 1[2]	
Type	uint8	uint8	uint8	uint8	uint16	uint8	uint8	

Byte	16	17	18	19	20	21	22	23
Name	Priority IP 1[1]	Priority IP 1[0]	Priority IP 2[3]	Priority IP 2[2]	Priority IP 2[1]	Priority IP 2[0]	Timeout (minutes)	Whitelist Usage
Type	uint8	uint8	uint8	uint8	uint8	uint8	uint8	bool

Byte	24	25	26	27	28	29	30	31
Name	Whitelist IP 1[3]	Whitelist IP 1[2]	Whitelist IP 1[1]	Whitelist IP 1[0]	Whitelist IP 2[3]	Whitelist IP 2[2]	Whitelist IP 2[1]	Whitelist IP 2[0]
Type	uint8	uint8	uint8	uint8	uint8	uint8	uint8	uint8

Byte	32	33	34	35	36	37	38	39
Name	Whitelist IP 3[3]	Whitelist IP 3[2]	Whitelist IP 3[1]	Whitelist IP 3[0]	Whitelist IP 4[3]	Whitelist IP 4[2]	Whitelist IP 4[1]	Whitelist IP 4[0]
Type	uint8	uint8	uint8	uint8	uint8	uint8	uint8	uint8

MODBUS EXCEPTION CODES

Code	Name	Explanation
0x01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the server. This may be because the function code is only applicable to newer devices and was not implemented in the unit selected. It could also indicate that the server is in the wrong state to process a request of this type, for example because it is unconfigured and is being asked to return register values.
0x02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the server. More specifically, the combination of reference number and transfer length is invalid. For a controller with 100 registers, the PDU addresses the first register as 0, and the last one as 99. If a request is submitted with a starting register address of 96 and a quantity of registers of 4, then this request will successfully operate (address-wise at least) on registers 96, 97, 98, 99. If a request is submitted with a starting register address of 96 and a quantity of registers of 5, then this request will fail with Exception Code 0x02 “Illegal Data Address” since it attempts to operate on registers 96, 97, 98, 99 and 100, and there is no register with address 100.

Code	Name	Explanation
0x03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for server. This indicates a fault in the structure of the remainder of a complex request, such as that the implied length is incorrect. It specifically does NOT mean that a data item submitted for storage in a register has a value outside the expectation of the application program, since the MODBUS protocol is unaware of the significance of any particular value of any particular register.
0x04	SERVER DEVICE FAILURE	An unrecoverable error occurred while the server was attempting to perform the requested action.
0x05	ACKNOWLEDGE	Specialized use in conjunction with programming commands. The server has accepted the request and is processing it, but a long duration of time will be required to do so. This response is returned to prevent a timeout error from occurring in the client. The client can next issue a Poll Program Complete message to determine if processing is completed.
0x06	SERVER DEVICE BUSY	Specialized use in conjunction with programming commands. The server is engaged in processing a long–duration program command. The client should retransmit the message later when the server is free.
0x08	MEMORY PARITY ERROR	Specialized use in conjunction with function codes 20 and 21 and reference type 6, to indicate that the extended file area failed to pass a consistency check. The server attempted to read record file, but detected a parity error in the memory. The client can retry the request, but service may be required on the server device.
0x0A	GATEWAY PATH UNAVAILABLE	Specialized use in conjunction with gateways, indicates that the gateway was unable to allocate an internal communication path from the input port to the output port for processing the request. Usually means that the gateway is misconfigured or overloaded.
0x0B	GATEWAY TARGET DEVICE FAILED TO RESPOND	Specialized use in conjunction with gateways, indicates that no response was obtained from the target device. Usually means that the device is not present on the network.

CDDP-A DATA SPECIFICATIONS TABLE

	CD200DP-A	CD400DP-A	CD600DP-A	CD1200DP-A
TABLETOP FOOTPRINT (L X W X H)	22.8x48.2x30.5 cm	22.8x48.2x30.5 cm	22.8x48.2x30.5 cm	30.5x33x48.2 cm
UNIT WEIGHT	19.6 kg	20.2 kg	20.8 kg	30.4 kg
INPUT VOLTAGE	90 - 250 VAC	90 - 250 VAC	90 - 250 VAC	90 - 250 VAC
FREQUENCY RANGE	47 - 63 Hz	47 - 63 Hz	47 - 63 Hz	47 - 63 Hz
POWER FACTOR (typ.)	PF>0.94/230 VAC PF>.99/115 VAC	PF>0.94/230 VAC PF>.99/115 VAC	PF>0.94/230 VAC PF>.99/115 VAC	PF>0.94/230 VAC PF>.99/115 VAC
POTENTIAL PEAK INPUT ACTUAL AVERAGE CURRENT (welding)	5A/115 VAC 3A/230 VAC	5A/115 VAC 3A/230 VAC	5A/115 VAC 3A/230 VAC	10A/115 VAC 6A/230 VAC
SINGLE AND DUAL PULSE	YES	YES	YES	YES
PULSE 1 ENERGY ADJUSTMENT	0-30%	0-30%	0-30%	0-30%
PULSE 2 ENERGY ADJUSTMENT	0-100%	0-100%	0-100%	0-100%
WELD PULSE CHARACTERISTICS				
MIN AND MAX OUTPUT	0.2 ws - 200 ws	0.2 ws - 400 ws	0.2 ws - 600 ws	0.2 ws - 1,200 ws
MIN AND MAX PULSE WIDTH	0.27 ms - 19.5 ms	0.29 ms - 30 ms	0.31 ms - 40.5 ms	1.13 ms - 60 ms
RISE TIME (to max voltage)	0.2 ms	0.2 ms	0.2 ms	0.2 ms
MIN AND MAX PULSE HEIGHT	1.1 V - 15.8 V	0.9 V - 18.3 V	0.8 V - 19.4 V	0.3 V - 19.4 V
WELDS PER MINUTE BY % OF TOTAL WELD ENERGY (IN DUAL PULSE MODE, MAX ENERGY, PULSE WIDTH AT 100%)				
0.10% with both pulses enabled	650 (0.2 ws)	600 (0.4 ws)	530 (0.6 ws)	460 (0.x ws)
0.10%	550 (0.2 ws)	530 (0.4 ws)	500 (0.6 ws)	260 (0.x ws)
1%	450 (2 ws)	290 (4 ws)	240 (6 ws)	214 (0.x ws)
5%	250 (10 ws)	160 (20 ws)	130 (30 ws)	120 (0.x ws)
10%	190 (20 ws)	120 (40 ws)	90 (60 ws)	85 (0.x ws)
25%	130 (50 ws)	70 (100 ws)	60 (150 ws)	52 (0.x ws)
50%	90 (100 ws)	50 (200 ws)	40 (300 ws)	36 (0.x ws)
100%	60 (200 ws)	30 (400 ws)	30 (600 ws)	23 (0.x ws)
PEAK WELD CURRENT* (BY EXTERNAL CABLING GAUGE NUMBER, AWG. FOUR AND EIGHT AWG IS TYPICAL FOR HAND-HELD ATTACHMENTS)				
1 AWG 8ft	6583	7625	8080	8500
4 AWG 8ft	4575	4910	5225	5800
8 AWG 8ft	3038	3520	3730	3960

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