QV-Box Series AB-3 Rev2

Soldering

Controller

Manual

Antaya Technologies Corp.
333 Strawberry Field Road
Warwick, RI 02886-2459 USA

Table of Contents

Section I - Introduction

Section II - Setup and Programming

Section III - Optimizing Soldering Parameters

Section IV - Electrode Materials

Section V - Technical Specifications

Introduction

The Antaya QV-Box Series AB-3 Rev2 (Triple) is the latest addition to the successful line of Q-box soldering controllers. The Series AB uses a Allen-Bradley Programmable Logic Controller (PLC) and Panel View HMI along with accurate energy measurement to precisely determine the quantity of energy being delivered to two independent terminals. It is therefore possible to achieve reliable, consistent soldering.

The easy to use operator interface with its touch screen user interface on the front panel of the QV-Box Series AB-3 Rev2 makes verifying and changing parameters easy.

The QV-Box Series AB-3 Rev2 is available in a 230V model.

The standard QV-Box Series AB-3 Rev2 comes equipped with integral vacuum generators and solenoid valves for part retention and built in controls for the solder tool vacuum cups eliminating the need for a separate V-box.

Optional equipment includes the following:

Custom electrode holder with vacuum part retention.

Remote lamps with a 15-foot (5 meter) cord.

Vacuum Sensors for part presence verification.

Remote inputs for solder start and vacuum cup release.

Many types of custom fixturing or alteration for special applications. (Please contact factory for more information.)

Ethernet/IP Networking capability for interfacing with customer equipment.

Setup

Plug the QV-Box into a 230V outlet with a minimum 15-amp capacity. Place the eyes of the electrode cables over the brass output studs and tighten the knobs over them. These are labeled "Circuit 1" and "Circuit 2" and “Circuit 3”. If the ends of the carbon electrodes are broken or jagged, re-dress them by sanding or filing them flat at the tip, perpendicular to the outer body.

Programming

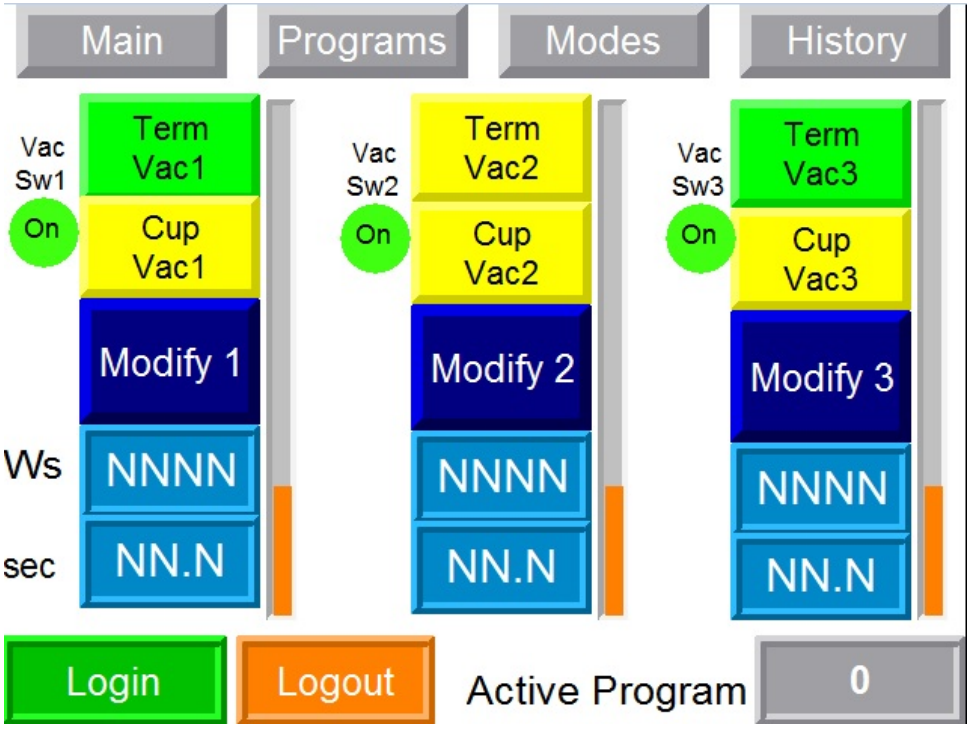
The Series AB-3 Rev2 QV-Box utilizes a PLC (programmable logic controller) and watt-second transducers to accurately measure the energy being delivered.

Turn on the QV-Box using the front panel switch. The operator interface display will come on, and it will show the Antaya Logo on the Startup Screen.

Start Up Screen

From this screen touch the "MAIN" button to get to the main controller display for soldering operations. The QR Code can also be scanned with a smart phone which will guide you to the Antaya.com website for service, support, and customer service contact information.

Main Screen



The **MAIN** Screen is used to monitor soldering operation and access other parameters for soldering.

The **Login** button in the bottom left of the screen is used to prevent unauthorized access to the soldering parameters, programs, and modes. To login, touch the login button on this screen. The login screen will appear. Press the user name display and type the user name and press enter on the keypad display. The default user name is **user**. Press the password display and type the password and press enter on the keypad display. The default password is **7272**. When this is complete press enter on the login screen and you are logged into the controller.

Once you are logged in you will have access to the **Modify**, **Programs**, and **Modes** Screens. You will be automatically logged out of the controller after an inactivity period of 3 minutes or you can log out manually using the **Logout** button. You will have to log back in after this period to modify any settings.

The **Active Program** displays the current program number that is being used for soldering

The **Ws** displays the amount of energy in Watt-seconds delivered to each circuit during the soldering process.

The **sec** displays the amount of time in seconds required to deliver the energy or Time of Delivery.

The **Bar** along the right of each circuit is also used to monitor the delivery of energy to the solder circuit. The bar will fill from bottom to top as the energy is delivered and will turn green at the top when the required amount of energy has been delivered. This is merely a more visual monitoring of the **Ws** display above.

The **Term Vac** button is used to toggle the vacuum On/Off to the solder tool for holding the terminal in the nest prior to soldering and the **Cups Vac** button is used to toggle the vacuum On/Off to the solder tool for holding the tool down on the glass . These will also turn on automatically when a new program is loaded that was saved with this setting in the On position. This can be turned Off to save compressed air during non-working times or when cleaning carbons to eliminate debris in the vacuum circuit.

The **Modify** buttons are used to change the soldering parameters. To access this screen you must be logged in the controller to prevent unauthorized changes. If you are logged in and press the Modify button for any circuit the following screen will appear.

The **Vac Switch** indicator is active if the vacuum sensor option is installed on the QV-Box. These indicators will show if the vacuum sensors are on when the components to be soldered are installed in the solder tool. If this option is installed and enabled the solder process will not start before these sensors are on prior to soldering.

<u>Modify Screen</u>

Touch the **High Power** to change the total amount of energy to be delivered to this circuit. Type the new value into the numeric keypad and press enter. The new value will be displayed in the numeric box on the right.

Touch the **Low Power** to change the total amount of energy to be delivered to this circuit before switching to High Power mode. Type the new value into the numeric keypad and press enter. The new value will be displayed in the numeric box on the right. To prevent electrode arcing (sparking), every solder cycle starts at a lower power level until contact is established. It is usually set at 50 WS.

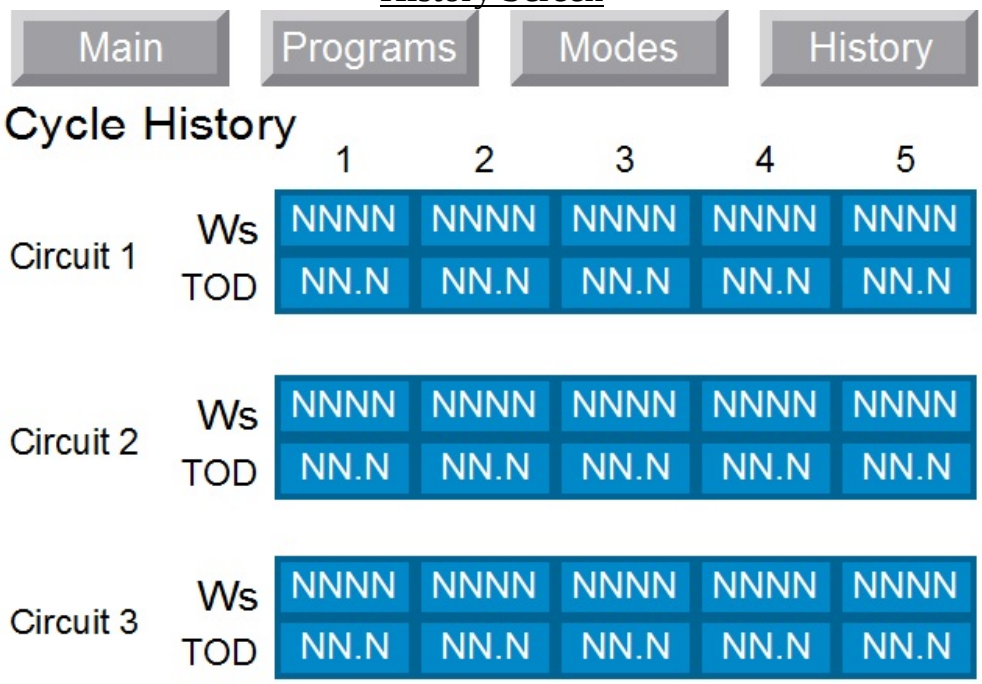
Touch the **Cool Down Time** to change the amount of time to blow the cooling air after soldering. Type the new value into the numeric keypad and press enter. The new value will be displayed in the numeric box on the right. At the end of the High Power energy delivery, the Cool Down timer starts. This timer should be set for an amount of time that allows for solidification of the solder. The QV-Box's blue Cool-Down light will come on to notify the operator that the soldering handle can be removed.

Touch the **Time Out Time** to change the amount of time allowed for the total energy to be delivered before the system rejects the soldering cycle. Type the new value into the numeric keypad and press enter. The new value will be displayed in the numeric box on the right. At the beginning of the high power cycle, the Time Out timer starts. If this timer should time-out before the high power cycle finishes, it will cut power to the electrodes and turn on the amber time-out light to inform the operator of a malfunction.

Touch the **Reset Time** to change the amount of time after each solder cycle is complete or timed out before it is prepared for the next cycle and the terminal vacuum is turned back on. Type the new value into the numeric keypad and press enter. The new value will be displayed in the numeric box on the right. (Note: if the last soldering cycle was successful, the Cool Down light will remain on until the Q-Box starts to deliver energy to the next part.)

Touch the **Back** button to return to the main screen after soldering parameters have been set.

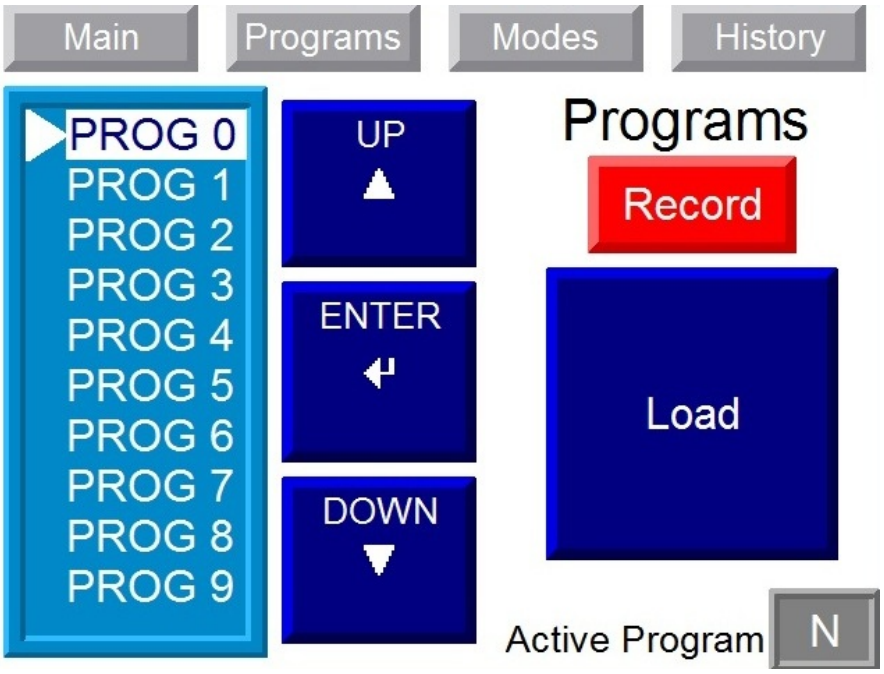
History Screen



The **History** screen is accessed by touching the button at the top of the Main screen. This screen is always available and does not require a login. This screen shows the history of the last 5 solder cycles of each circuit for troubleshooting purposes. The total energy in WS and the Time of Delivery(TOD) to deliver that energy.

The most recent is number 1 and the oldest is number 5. As you solder the oldest value drops out so the most recent 5 cycles are always displayed.

Programs Screen



The **Programs** screen is accessed by touching the button at the top of the Main screen. This screen is available only when logged in to the controller. This is used to save and recall programs for use with different solder tools or for different products. There are 10 programs available numbered 0-9. The program number in use is displayed in the "Active Program" box.

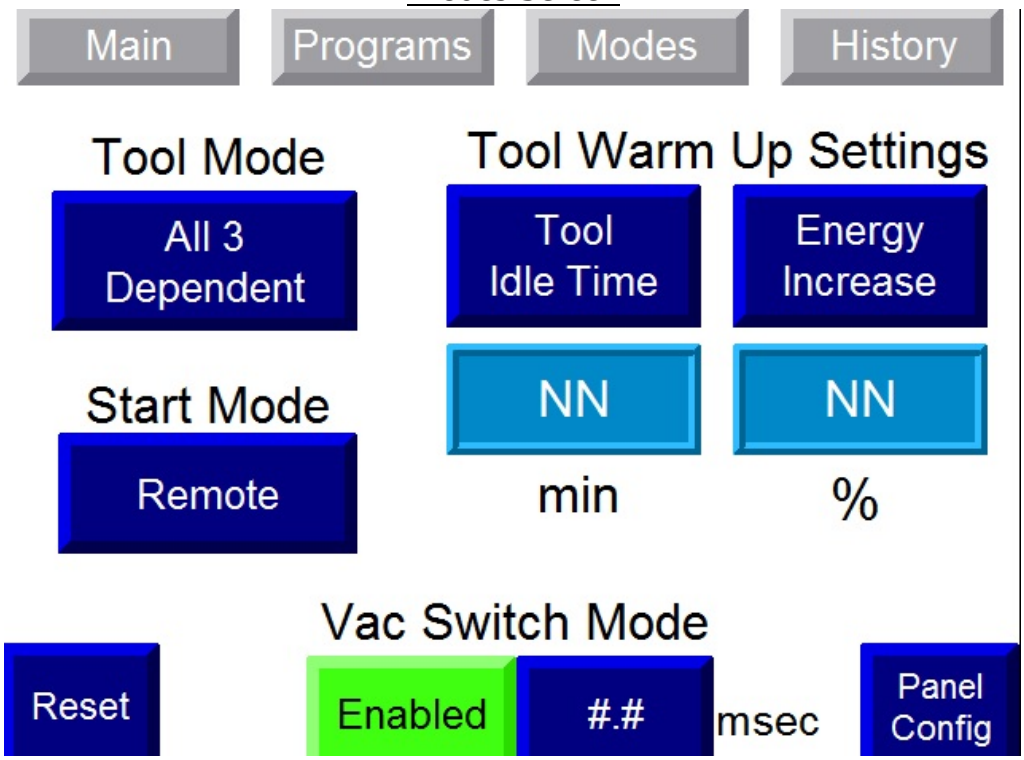
To **Load** a program is to recall it from memory and make it the Active Program in use by the controller. First you select the program number on the list on the left by using the Up and Down buttons until the proper program number is highlighted. You must then use the Enter key to confirm this selection. Once this is done hit the Load button to recall the settings for this program from memory and make this the Active Program. The new program number you selected will be displayed in the lower right corner. This is also displayed on the Main screen.

The settings that are loaded include all the solder parameters on the Modify Screen as well as the selections of Vacuum On or Off on the Main Screen. These are loaded for both circuits.

To **Record** a program is to memorize the current settings in use by the controller into a specific program number in memory. This does not change the Active Program in use by the controller. Once all the settings on the controller are set to where they need to be saved, you select the program number on the list on the left by using the Up and Down buttons until the proper program number is highlighted. You must then use the Enter key to confirm this selection. Once this is done hit the Record button to memorize the settings for this program into memory.

The settings that are recorded include all the solder parameters on the Modify Screen as well as the selections of Vacuum On or Off on the Main Screen. These are recorded for both circuits.

Modes Screen



The **Modes** screen is accessed by touching the button at the top of the Main screen. This screen is available only when logged in to the controller. This is used to set operating modes in the Q-box.

Tool Mode

If two terminals are to be soldered simultaneously, as in the case of a two-terminal handle, then use 1-2 Dependent Mode to prevent one side from starting another cycle while the other side is finishing its cycle. If one set of vacuum cups is being used with a two-terminal handle, then using 1-2 Dependent Mode will prevent a double soldering cycle on one terminal while waiting for the other finish. Likewise, if on tool contains three circuits with one set of vacuum cups then set this mode to All 3 Dependent. In either case the vacuum cups supply line should be hooked into the port for the circuit 1 vacuum cups for the dependent solder tool.

If this is set to Independent Mode, then the three circuits act independently from each other. This is the same as having three single QV-Box's.

This is changed by touching the dark blue box to toggle between Dependent/Independent Modes. The current mode is displayed in the box.

Start Mode

The start mode can be set to Auto or Remote. If this is set to Auto the solder process will start as soon as the electrodes make contact with the soldered components. If this is set to Remote the solder process will not start until the electrodes make contact and the remote input for solder start turns on the remote input connection on the side of the QV-Box.

Tool Warm Up Settings

These settings may be used to help solder with a cold tool that has not been used for a while. Some slight heating differences can occur when soldering with a tool that has not been warmed-up. These settings allow you to specify an increased amount of energy to be delivered if the solder tool has been idle for too long.

Press the **Tool Idle Time** box to specify the amount of idle time, in minutes, that will cause the energy to be increased. Type the setting on the numeric keypad that pops up and press enter. Allowable settings are from 0-60 minutes.

Press the **Energy Increase** box to specify the percentage increase of energy to be delivered on the first cycle after the idle time has been reached. Type the setting on the numeric keypad that pops up and press enter. Allowable settings are from 0-20 percent. Set this to 0 if no energy increase is desired.

These settings will only be active on the first solder cycle after the Q-box has been idle for the specified idle time. The percent increase is applied to the High Power setting and the Cool Time for both circuits. After the first solder cycle the idle timer is reset and must be idle again for the specified time for this increase to occur.

Vac Switch Mode

If this option is enabled the solder process will not start unless the vacuum switch inputs are on prior to soldering. This is used to confirm that a part is loaded into the tool before allowing the soldering process to start. It is possible for this vacuum input to go off slightly before the electrodes make contact so there is also an adjustable timer next to the mode set button. This timer allows you to set the amount of time between when the vacuum sensor goes off and when the solder process can start. This time is usually less than 500 msec.

If the remote start option and the vacuum switch option are both enabled then this timer will need to be set longer than the amount of time between when the tool contacts the glass and the remote start switch is activated. If both these options are enabled and this timer expires before the remote start input is activated the solder process will not start.

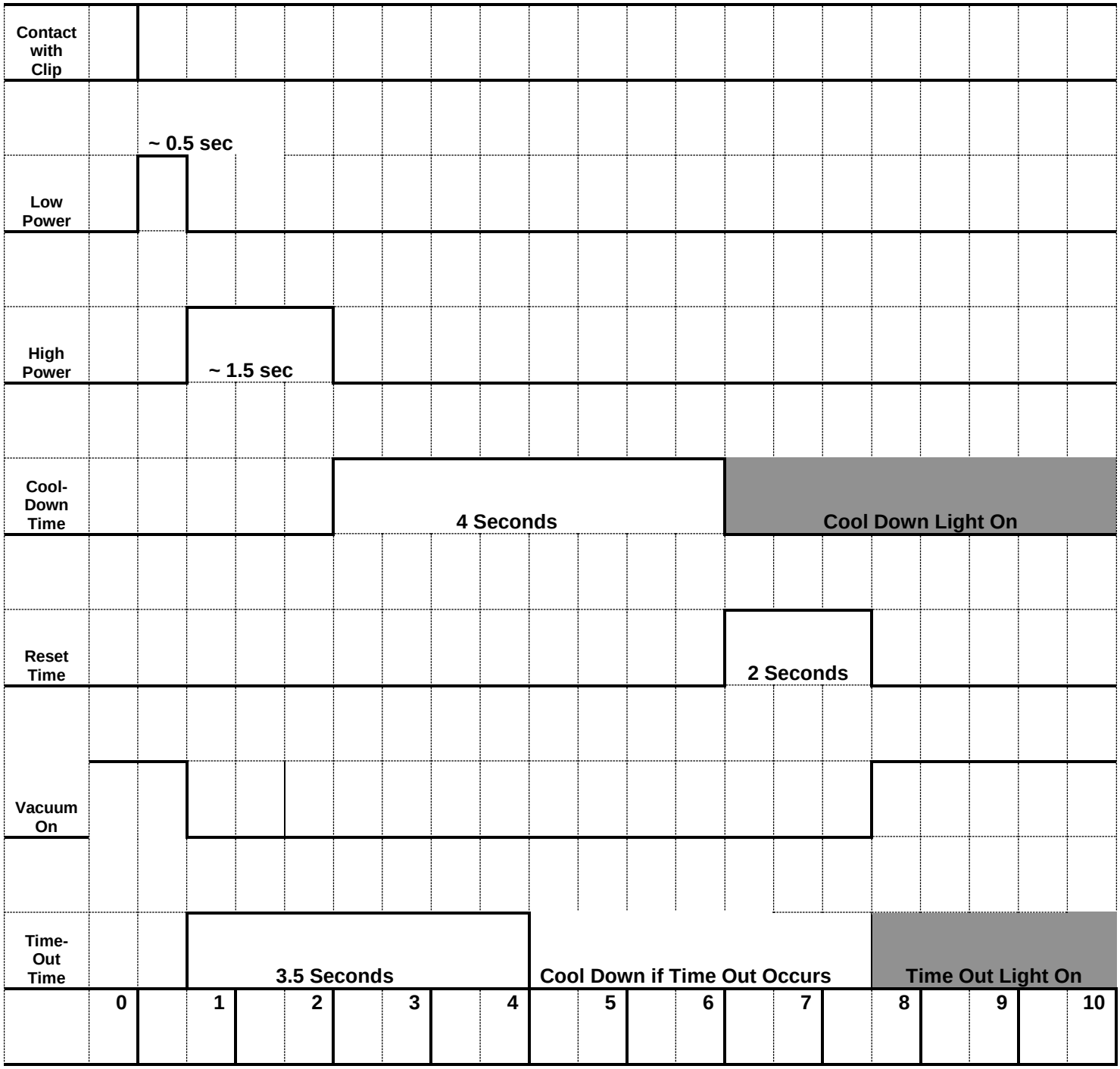
Reset

The Reset button is provided to set the controller back to a starting condition if an unknown error occurs in the PLC. This will set the soldering cycle back to a condition ready for soldering that can occur due to power failure in mid cycle or other unknown conditions. This will not change the settings in use or the programs in memory.

Panel Config

This button is to allow access to the Configuration settings of the Allen-Bradley Panel View HMI. This does not affect any soldering parameters and should only be used by qualified technicians. Changing any of these settings without proper knowledge and training can cause the Panel to malfunction or lose communications with the PLC.

Timing Chart



Optimizing Soldering Parameters

The most important parameter to optimize is the **High Power** level. This level directly affects the strength of the solder joint. There are a wide range of settings which will melt the solder so it appears good but a much smaller range of settings where the strength of the solder joint is at its best.

To optimize the High Power level, obtain a set of parts the same as the parts you intend to use. Use a low (250 WS) setting and attempt to solder the parts together. If the solder doesn't melt, increase the High Power level in increments of **100 WS** until it does melt. The power level at which the solder begins to melt will be the lower limit of your experiment. The next step is to solder 10 parts together, the first at the lower limit, the next at the lower limit + 100 WS, the next at the lower limit + 200 WS etc. It is important to record which part was soldered at which level as this is done.

Once these 10 parts have been soldered, pull them apart again using some sort of device with which the maximum force can be recorded. Record the results with the corresponding watt-second value for each. Under inspection, the pull test values should show an increase in strength up to a point, and then a decrease in strength past that point. Set the High Power WS value at the level that resulted in the highest pull test value.

The next most important parameter is the **Time-Out** time. To determine the best setting, solder several pieces using the optimized High Power setting and a default Time-Out time of **5 seconds**. Pull-test them and record the results. Next, reduce the Time-Out by **0.5** seconds, solder some pieces and pull test them. If the pull-test values do not go down, decrease the time-out time by another 0.5 seconds and pull-test some more samples. If the values drop below the required pull-test strength, set the Time-Out time back to the previous setting. Any cycle taking longer than this will turn on the amber Time-Out light and will cut power to the piece.

The **Low Power** level should be set at a value that allows time for good placement of the electrodes before High Power begins. This is typically set at **50 WS**, but may be shortened for an easy to place part. It may be lengthened for a difficult to place part or if initial contact brings the count above 50 WS and the high power cycle starts before good contact is achieved. It shouldn't be set for more than **90 WS**.

The C**ool-Dow**n time should be set long enough for solder to solidify so the part is not displaced when the electrodes are removed.

The **Reset Time** should be set long enough for the electrodes to safely be removed from the part so that the next cycle does not begin while still in contact with the just completed part.

Electrode Materials

To generate the heat required to melt solder, a carbon material is used for electrodes. This carbon has a resistance that generates the heat in the electrodes which is then conducted to the part. By doing this, much energy is saved trying to heat low resistance materials. This also means that the electrodes need not be perfect in shape or contact to work properly.

Carbon has a slight softness that allows some level of conformity in manual operations. This makes for an electrode that is more likely to work properly even if it is held poorly or unsteadily. Because of its softness, there is a need to occasionally redress the tips of the electrodes. Care must be taken to prevent lateral forces on the electrodes during soldering, as their brittleness may make them subject to breaking.

Other materials frequently associated with resistance welding, i.e. tungsten, copper, moly, or Inconel are inappropriate due to their low resistance. They all require significantly more energy, requiring much heavier and more expensive hardware. They are also much more sensitive to electrode shape and condition, and if positioned poorly will result in bad solder joints.

Technical Specifications

Power:	200-240 VAC, 15 Amps, 50/60 Hz
	Single Phase
Air:	70-125 PSI, 9-12 CFM, depending on pressure.