Linear Vibration Welder
4000 Series
Model VWB-4300/4500/4700/4900
User's Manual
# Revision History

<table>
<thead>
<tr>
<th>Revision Number</th>
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<th>Date</th>
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<tr>
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SECTION 1

Introduction

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General User Information

Read This Manual First
Before operating your linear vibration welder, read this User’s Manual to become familiar with the equipment. This will ensure correct and safe operation. The manual is organized to allow you to learn how to safely operate this equipment. The examples given are chosen for their simplicity to illustrate basic operation concepts.

Notes, Cautions and Warnings
Throughout this manual we use NOTES to provide information that is important for the successful application and understanding of the product. A NOTE block is shown to the right.

In addition, we use special notices to make you aware of safety considerations. These are the CAUTION and WARNING blocks as shown here. They represent increasing levels of important information. These statements help you to identify and avoid hazards and recognize the consequences. One of three different symbols also accompany the CAUTION and WARNING blocks to indicate whether the notice pertains to a condition or practice, an electrical safety issue or an operator protection issue.

Drawings and Tables
The figures and tables are identified by the section number followed by a sequence number. The sequence number begins with one in each section. The figures and tables are numbered separately. The figures use Arabic sequence numbers (e.g. –1, –2, –3) while the tables use Roman sequence numerals (e.g. –I, –II, –III). As an example, Figure 3–2 would be the second illustration in Section Three while Table 3–II would be the second table in Section Three.
Welder Overview

The linear vibration welder excels at joining large assemblies and parts made from glass–filled and high performance plastics.

The VWB4X00 (Vibration Welder 4300/4500/4700/4900) family is Dukane’s third generation linear vibration welder. These new systems all share the same basic mechanical components, software and electronic controls.

The VWB4X00 differences are in the size of tooling they can accommodate. The tooling capacity for each model is:

- **VWB4300** ............24 in. wide by 18 in. deep
  610 mm wide by 457 mm deep

- **VWB4500** ............38 in. wide by 18 in. deep
  965 mm wide by 457 mm deep

- **VWB4700** ............52 in. wide by 24 in. deep
  1,321 mm wide by 610 mm deep

- **VWB4900** ............72 in. wide by 24 in. deep
  1,828 mm wide by 610 mm deep

All VWB4X00 models have the same vertical clearance of 26 inches (660 mm) between the lift table and upper springs, and they all have a 20-inch (508 mm) stroke. Unlike competing machines, the upper vibration spring is not held in place by a swing frame. It incorporates a frameless design which has less vibrating mass to accommodate heavier tooling and provide additional tooling clearance.

The hydraulic system uses a commercial, readily available, self–contained system. This allows customers to do some of their own parts replacement, and it minimizes costly field service calls.

The new and larger color operator interface is also a commercial unit containing Dukane’s field–tested and proven control software and interface. Every subassembly has been selected to provide the maximum reliability with a long and economical service life. The electrical cabinet has been redesigned to increase reliability, minimize emissions and meet the applicable CE regulations.
Key Features

- **Color Touch Screen Display** uses Color Active Matrix Thin-Film Transistors (TFT) for high contrast and wide viewing angle even under high ambient-lighting conditions. The display provides for all monitoring and programming of the weld cycle.

- **Intuitive User Interface** allows for quicker programming and less down time.

- **English or Spanish** menus shorten training time, reduce operator errors and broaden the usefulness of the machine. *(Other languages are available.)*

- **Built-In Diagnostics** minimize down time. Custom automation outputs are a standard feature.

- **Tooling Automation Capability** options include pick-and-place systems, conveyor pass-through and/or part feed systems. Control for automation can be added to the core software.

- **Digital Auto-Tuning** accurately and automatically adjusts the frequency of the magnetic drivers to within 0.01 Hz. This provides optimum performance for each separate tooling assembly.

- **Eliminating the Swing Frame** reduces the mass of the upper tooling bridge. This permits the welder to handle a wider range of tooling weights. It also provides more clearance for tooling.

- **Optimized Magnetic Drive Heads** enable the welder to handle heavier tooling at higher frequencies than competing units, with resulting shorter weld times.

- **Commercial Subassemblies** are used to ensure a longer and more economical service life, than units built with proprietary components. These readily available items also lessen the need for expensive field service calls.

- **Reinforced Subframe** and four ultra-rigid guide rails resist side loads and provide greater stability. This results in more accurate and repeatable lift table positioning.

- **Digital Linear Encoder** is directly attached to the lift table to accurately measure and control the table's position to within 0.01mm (0.0004 inch).

- **Hydraulic Lift/Clamp System** is self-contained. Uses standard off the shelf components for ease of maintenance.

- **Weld By Time or Distance** is standard (either absolute or meltdown). Built-in sensors give you the choice of triggering by position or zero motion.

- **Parameter Monitoring** with programmable upper and lower limits of time, distance, amplitude and force.

- **Auto-Ping** allows an auto-tune automatically after a selected number of cycles.

- **Trigger** by position or by zero motion.

- A **two-phase drive** has been incorporated into these 4000 Series vibration welders.

- **Standard Software** supports five part present sensor inputs, and controls up to four programmable valves, vacuum and profiling.

- **Dedicated Sensor Input** for each programmable valve with option to enable or bypass.
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General Considerations

Please observe these health and safety recommendations for safe, efficient, and injury-free operation of your welder. In this manual, the term *welder* and/or *machine* both refer to the linear vibration welder.

**Proper Installation** - Only operate the welder after all tooling is installed, and the hydraulic, pneumatic and electrical systems are properly checked out.

**No Unauthorized Modifications** - Do not modify your welder in any way unless authorized to do so by Dukane Corporation. Unauthorized modifications may cause injury to the operator and/or equipment damage. In addition, unauthorized modifications will void the equipment warranty.

**Keep the Service Doors Closed** - Do not bypass or remove any interlocks unless specifically directed to do so by Dukane Corporation. The magnetic drivers produce high electrical voltages which could cause injury or death. In addition, the hydraulic lift table produces more than 5,000 pounds of lift force.

**Grounded Electrical Power** - Operate this equipment only with a properly grounded electrical connection. Refer to the NEMA L16–30 wiring diagram in Figure 2-2 on Page 11. If there is any question about the grounding of your AC power, have it checked by a qualified electrician.

**Comply with Regulations** - You may be required to add accessories to bring the system into compliance with applicable OSHA regulations for machine guarding and noise exposure.

**Operate Safely** – Do not operate the welder if under the influence of alcohol or drugs. Read the warning labels on prescriptions to determine if your judgement or reflexes are impaired while taking drugs. If there is any doubt, do not operate the machine.

*Continued*
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**Foot Switch** - Using a foot switch in place of the optical touch finger switches (activation switches) violates OSHA regulations.

**System Electrical Cabling** - Electrical power must be off when connecting or disconnecting electrical cables.

**Do Not Wear Loose Clothing or Jewelry** - These or similar items can become caught in moving parts.

**Stay Alert** - Watch what you are doing at all times. Use common sense. Do not operate the equipment when you are tired or distracted from the job at hand.

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**CAUTION**

Parts being joined with the linear vibration welder will at times vibrate at audible frequencies. Wear ear protectors to reduce annoying or uncomfortable sounds. In addition, baffles, sound enclosures, or materials that absorb sound may be located to surround the system.

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**CAUTION**

When making cable connections to system equipment or disconnecting cables from system equipment, make sure electrical power to the system is turned off, and AC power cords are removed from their receptacles. After the cables have been securely connected and the connections and cable routing checked a final time, the power may be restored.
Special Health Notice - Plastics

Certain plastic materials, when being processed, may emit fumes and/or gases that may be hazardous to the operator’s health. Proper ventilation of the work station should be provided where such materials are processed. Inquiries should be made to the U.S. Department of Labor concerning OSHA regulations for a particular plastic prior to processing with Dukane welding equipment.

Electrical Safety

AC Power Receptacle

The power cord used on the Dukane vibration welder, Models 4300, 4500, and 4700, has a three-pole, four-blade, grounding type plug designed for 3-Phase 480 VAC at 30 Amps. The 480 VAC 3-Phase plug configuration is shown in Figure 2-1. It is designed to be plugged into a 480 VAC, 3-Phase, 30 Amp, NEMA type L16-30R receptacle as shown in Figure 2-2.

NOTE: Model 4900 is not supplied with a power cord.

Do not alter the plug or receptacle in any way. Do not use an extension cord. If there is any question about the grounding or phasing of your AC power, have it checked by a qualified electrician. See custom input voltage note in Section 13 – Specifications - AC Power.

AC Power Disconnect

Always turn off the AC power at the disconnect switch before opening any of the service doors or attempting any maintenance on the welder. The recommended practice is to also tag and lock out the disconnect switch. The CE-compliant AC disconnect is standard. Turn the switch to the off position as shown, then pull the center horizontal bar out to insert a lockout as shown in Figure 2-3. The handle style AC disconnect, which is also available, is shown in Figure 2-4 with a lockout and tag.

Electrical Cabinet Door

The electrical cabinet service door is mechanically interlocked to the CE-compliant AC power disconnect. The cabinet door cannot be opened without first turning off the AC power.
Pneumatic Safety

Always isolate and lock out the compressed air before performing any maintenance on the vibration welder. The isolation and lockout device is shown in Figure 2-5. The safety isolation device is installed externally, and is in series with the internal compressed air filter. When activated, this device will isolate the compressed air supply from the air filter and pneumatic actuators in the welder. This device complies with OSHA regulations.

Compressed air can develop a considerable amount of force. The force is large enough to inflict serious injury. The vibration welder uses two air cylinders which convert the air pressure to mechanical movement for opening and closing the front access door.

With the rear service doors open, you can see the compressed air filter and pressure regulator on the left side. This is shown in Figure 2-6. The filtered air is fed to the air distribution manifold and pneumatic valves. Refer to Section 11 - Maintenance for information on the filter element and how to replace it.
Operational Safety

The service doors are interlocked to prevent access while the welder is energized. If either of the hydraulic doors are opened, the vibration welder will shut down. The electrical cabinet service door is shown in Figure 2-7. It cannot be opened without first turning off the CE-compliant AC disconnect. The rear hydraulic service doors are identified in Figure 2-8.

The front loading area is protected by a sliding access door. This door is operated by two air cylinders which are driven by compressed air. The door raises at the start of a welding cycle to prevent access to the tooling and lift table. The door also serves as part of the sound enclosure. Sensors on the access door will stop the welder if the compressed air fails and allows the door to open partially during a weld cycle.

The safety light curtains prevent any access to the loading area once the machine cycle has started and before the access door is fully closed. Breaking the light beam while the door is in transition will cause the machine to halt operation. The light curtains are identified in Figure 2-7.

**WARNING**

Never attempt to remove the filter housing while the compressed air is on. Turn off the compressed air using the pneumatic lockout device, and make sure the pressure gauge reads zero.
Hydraulic Safety

The hydraulic system is self-contained. It normally operates at between 1,000 and 1,200 psi. It is however capable of operating up to 1,500 psi. It is unsafe to attempt to bypass the interlocks and operate the welder with the rear service doors open. The interlocks are located at the top of the electrical and both hydraulic service doors. Figure 2-9 shows a door interlock device and the mating receptacle in the cabinet.

The vibration welder may be shipped with the hydraulic fluid reservoir full or drained, depending on whether the destination is local or international. Before operating the welder, hydraulic fluid must be added to the reservoir if it is empty. This is covered in Section 3 – Installation, Hydraulic Drive.

WARNING

Never operate the vibration welder with any of the service doors open. This is an unsafe practice and can result in injury or death.

The rear service doors also serve as acoustic shields.
SECTION 3

Installation

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Unpacking
The vibration welder is normally shipped on a skid with tie-down boards inserted through the forklift channels and bolted to the skid (see Figure 3-1). If tooling was ordered, it may be left installed if the alignment is complex. If the tooling is heavy, it may be removed from the welder and packaged separately. The welder may be shipped with the hydraulic fluid reservoir full or drained, depending on whether the destination is local or international. System documentation was placed in a pocket at the inside bottom of the electrical service cabinet door (see Figure 3-2). This material includes: the user's manual, electrical, pneumatic, and hydraulic diagrams, and bills of material. Store the documents there for safekeeping and future reference. The forklift channel cover plates are also in a box in the electrical cabinet.

Welder Placement
Ventilation
When plastic materials are being processed, they may emit fumes and/or gases that could be hazardous. Make sure you have adequate ventilation whenever these plastics are processed.

Part Handling Considerations
Allow space on either side of the vibration welder for material handling, work pieces and fixtures. Consider whether the operator is sitting or standing. The operator should be at a comfortable height relative to the activation switches to prevent operator fatigue. Provide ample room so the movement of the operator does not interfere with part handling. Also allow room for future expansion of automation equipment or pass-through conveyor systems. See the space requirements drawings in Section 13 - Specifications.

Energy Sources
Refer to Section 13 - Specifications for the AC power requirements and for the compressed air requirements of your model.
Floor Area

The floor area required for the vibration welder depends on the model and capacity of the machine. Detailed dimensions are given in Section 13 – Specifications. The left side of the welder does not require access and can be placed close to a wall if desired. The front of the welder should have a minimum clear space of at least 36 inches for the operator work area. The total minimum recommended floor area is listed in Table 3-I.

<table>
<thead>
<tr>
<th>VWB Model</th>
<th>Width (in/m)</th>
<th>Depth (in/m)</th>
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<tr>
<td>4300</td>
<td>48 / 1.22</td>
<td>73.80 / 1.87</td>
</tr>
<tr>
<td>4500</td>
<td>125 / 3.18</td>
<td>105 / 2.67</td>
</tr>
<tr>
<td>4700</td>
<td>143 / 3.63</td>
<td>117 / 2.97</td>
</tr>
<tr>
<td>4900</td>
<td>163 / 4.14</td>
<td>127 / 3.23</td>
</tr>
</tbody>
</table>

Table 3-I Minimum Floor Area by Model

Forklift Channels

The vibration welder has built-in forklift channels. Cover plates for the front and rear channels are supplied. The front channels are shown in Figure 3-3. Directly above the channels the stenciling reads LIFT HERE. The rear forklift channels are shown in Figure 3-4 without the cover plates installed. During shipping, tie-down boards are inserted through these channels to secure the welder to the skid as shown in Figure 3-1.

Determine your forklift requirements by referring to Section 13 – Specifications, for approximate machine weight.

Once the welder is positioned in its final location, secure the four cover plates over the front and rear forklift channels. The cover plates have 1.5 inches of sound-absorbing foam on their back to act as acoustic dampers to reduce the reverberations emitted from the forklift channels. The covers are shown in Figure 3-5. The covers must be installed so the vibration welder will meet the specified sound emission requirements of 80 dBA during operation.

WARNING
Do not operate the vibration welder without the front and rear forklift channel cover plates. These plates serve as acoustic dampers to reduce the reverberations from the steel channels.
**Leveling**

The vibration welder is leveled at the factory. The feet are self-leveling to an extent. If your floor is close to level, no adjustment should be required. You should, however, check the lift table with a 3-foot carpenter's level to verify the trueness of the machine’s level. We recommend that the vibration welder be leveled to within one-half degree. One-half degree corresponds to approximately five-sixteens of an inch vertical deviation across 36 inches, or 9mm over 1000mm \( \tan 0.5^\circ = 0.00873 \). If any adjustment is required, the feet have lock nuts on threaded studs to level the welder.

**AC Power**

**AC Requirements**

Please refer to *Section 13 - Specifications*, Power Requirements, AC Power on Page 146.

---

**WARNING**

Always turn off the AC power at the main disconnect switch before servicing or working on the welder. Failure to turn off the AC power is an unsafe practice and can result in injury or death.
**AC Disconnect Switch**

The AC power cord is directly connected internally to the AC disconnect switch. To turn the AC power OFF, twist the red circular knob counterclockwise until it is pointing left to the Green OFF position as shown in Figure 3-6.

To turn the AC power ON, twist the red knob clockwise until it is pointing up as shown in Figure 3-7.

**Disengaging Switch Coupling**

To open the electrical cabinet, the CE-compliant disconnect switch must be in the OFF position as shown in Figure 3-6. First, unlock the door handle if it is locked. Pull the door handle out and then twist it to the left. This will release the door latch. Then, press the yellow tab on the disconnect housing against the red knob while keeping the switch in the OFF position as shown in Figure 3-8. This will release the knob coupling from the disconnect shaft and allow you to pull the door open.

To close the door, press the yellow tab on the disconnect housing against the red knob while keeping the switch in the OFF position. This opens the coupling lock. Push the door closed to engage the coupling, but do not force it. When the shaft coupling is engaged, release the yellow tab. Then, twist the door handle back to the right, and push the handle in to latch the door securely.
Compressed Air

The welder requires a supply of clean, dry, compressed air at 75 to 90 psi. The connection is made using 1/2 inch O.D. tubing at the pneumatic lockout device shown in Figure 2-5 and 7-2. The filter and regulator are inside the hydraulic cabinet and are shown in Figure 3-9.

The compressed air from the pneumatic lockout enters from the left. The filtered air exits to the right. The embossed arrow on the housing, below the pressure gauge indicates this airflow direction. The filtered air is fed up to the air distribution manifold above the filter (see Figure 2-6), which contains the pneumatic control valves. Each pneumatic device has its own remotely-controlled valve unit and flow controls. Adjusting the valves and flow controls is covered in Section 9 – Optimizing Performance.

The pressure gauge displays the pressure of the filtered air out. It is calibrated in psi. To adjust the pressure, lift the adjustment knob until the orange band is visible at the base of the knob. Turning the knob clockwise (when viewed from above) will increase the pressure. Push the knob back down to its locked position to prevent any changes in the setting.

The front cover of the gauge can be removed to adjust the set points. Twist the cover counterclockwise about 1/8 th of a turn and gently pull to remove the cover. Position the two green pointers at the desired lower and upper limits. They are normally set at the factory to about 75 psi and 85 psi (5.1 bar and 5.7 bar respectively). These pointers are only visual indicators, and do not override the regulator setting.

The canister below the pressure gauge contains the air filter and moisture trap. The air filter is self-draining of any accumulated moisture by means of a drain hose which exits the bottom of the machine. Keep this in mind if moisture draining to the floor could cause a problem. The filter has an internal float, and will empty under pressure when approximately 25 cm$^3 = 25$ ml (0.85 ounce) of water has accumulated. Refer to Section 11 - Maintenance, for complete information on the instructions for replacing the filter element.

WARNING

Never attempt to remove the filter housing while the compressed air is on. Turn off the compressed air using the pneumatic lockout device and make sure the pressure gauge reads zero.
Hydraulic Drive
Self–Contained System

The lift table is raised and lowered by hydraulic pressure. The hydraulic system has its own motor, pump, filter, reservoir, cooling system and programmable regulator. The valves and pressure regulator are controlled by parameters contained in a setup file and controlled by the welder’s PLC.

The drive unit is shown in Figure 3-10. The hydraulic pump is capable of generating a maximum of 1,500 psi (102 bar). The pressurized fluid drives a hydraulic cylinder which is located under the table and has a maximum stroke of 20 inches (508 mm). The maximum lift or clamp force available at the piston is a function of the hydraulic cylinder diameter. The specifications for each model are given in Table 3-II. The maximum programmable force is less than the available force. The program limits are given in Section 6 – Touch Screen Menus, User Options, Page 64.

Figure 3-10  Hydraulic Drive Unit

<table>
<thead>
<tr>
<th>VWB Model</th>
<th>Hydraulic Cyl. Dia.</th>
<th>Scale Factor</th>
<th>Max. Available Lift Force at Piston</th>
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<tr>
<td>4300</td>
<td>2</td>
<td>3.14</td>
<td>3140</td>
</tr>
<tr>
<td>4500</td>
<td>2</td>
<td>3.14</td>
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<td>4700</td>
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<td>4.91</td>
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</tr>
<tr>
<td>4900</td>
<td>2.5</td>
<td>4.91</td>
<td>7360</td>
</tr>
</tbody>
</table>

1 lb = 0.4536 Kg; 1 lb = 4.448 Nt; 1 Nt = 1 Joule/meter

Table 3-II  Lift/Clamp Force by Model
Adding Hydraulic Fluid

The vibration welder may be shipped with the hydraulic fluid reservoir full or completely drained, depending on whether the destination is local or international. Before operating the welder, hydraulic fluid must be added to the reservoir if it is low or empty. The reservoir has a capacity of 20 U.S. gallons (75.7 liters). Normal operating level is about 18.5 gallons (70 liters). This corresponds to a sight glass reading of 50%.

We prefer DTE® 25 because it has a higher temperature breakdown rating. Refer to Table 11-I for hydraulic fluids equivalent to DTE® 25.

To fill the reservoir, unscrew the filler cap shown in Figure 3-11. Pull out the strainer/filter. Add hydraulic fluid until the sight glass level gauge reads 50% as shown in Figure 3-12. There will still be fluid in the hydraulic cylinder so it is not necessary to completely fill the reservoir. Replace the strainer/filter and screw the filler cap back on. After the table has been cycled a few times, recheck the fluid level. It may be necessary to add more hydraulic fluid if the sight glass level has dropped below 50%.

CAUTION

Hydraulic fluid level should be maintained so that it always shows in the fluid level sight glass. This is important to prevent condensation from collecting on the inside of the reservoir and the heat exchanger tubes.
SECTION 4

Display and Controls

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Control Panel Layout

The control panel contains all of the switches, indicator lights and the display to set up and operate the vibration welder.

The control panel is shown in Figure 4-1. Brief explanations of the primary panel controls are given below.

A Color Touch–Screen Display
This touch screen uses color active matrix thin–film transistors (TFT) for high contrast and wide viewing angle even under high ambient lighting conditions.

The display provides for all monitoring and programming of the weld cycle.

Refer to Section 6 - Touch Screen Menus for information about the function of the various menus.

B Main Power (light)
When the main AC switch is turned on, this light is energized by the power supply, and it lights up. When this is lit, MAIN POWER indicates the +24V control power supply is ready.

C In Cycle (light)
The green IN CYCLE light is lit whenever the vibration welder is in the RUN mode. The light flashes when the welder has started a weld cycle.

When the weld cycle is done, the flashing stops and a steady green appears. The light goes out when the welder is switched to SETUP mode.

D Alarm (light)
The red ALARM light flashes during any kind of alarm condition such as the E-STOP button being pushed or when a service door is open. The light flashes in either the RUN or SETUP modes, and continues to flash, until the alarm condition has been cleared.
**E-STOP Reset** (button)

Pressing the button enables the operator to reset the welder when it is initially turned on or to clear an aborted cycle caused by:

1. Pushing the **EMERGENCY STOP** (E-STOP) button.
2. Opening the rear service doors.

**Hydraulic Pump On** (light/switch)

The hydraulic system is turned on by pushing in the green button. When the hydraulic pump is activated, the center of the switch is illuminated green. When the hydraulics are off, the center of the green button is dark. The lift table cannot be moved if the hydraulics are off. This is a push-on only switch. The hydraulic pump is turned off by:

1. Pushing the **EMERGENCY STOP** button in.
2. Opening the rear service doors.
3. Turning off the AC power

**E-STOP** (button)

The **E-STOP** button on the control panel is shown in Figure 4-1. The left mounting box contains an emergency stop (E-STOP) button next to the left **OPERATE** switch as shown in Figure 4-2. Both of these switches function the same, and pressing either switch stops the weld cycle and freezes the lift table in its current position.

Both emergency stop buttons must be in their reset position before the lift table can be lowered and the welder restarted.

**NOTE**

Follow the instructions shown in the message area at the top of the touch screen.
Operational Switches

H Opti-Touch Operate Switches

Located directly in front and below the sliding access door are two small mounting boxes that each contain an optical OPERATE switch. Their placement is shown in Figure 4-2. These identical switches use Infrared (IR) sensors. They comply with OSHA and CE safety standards. The operator can begin a weld cycle using either the left or the right switch alone.

Each optical-touch switch has a small red LED in the left front illuminated whenever the power is on, as shown in Figure 4-3 and 4-5. When the operator places his finger in the tray, a second LED at the right rear also illuminates to indicate the switch has been activated.

Figure 4-2 Operate Switch, Vacuum, and E-Stop Buttons, Light Curtains, and Utility Outlet Locations

Figure 4-3 Left Operate and E-STOP Button
Light Curtain

The light curtains are identified in Figure 4-2.

The right light curtain (receiver) contains five status LEDs at the top of the housing. See Figure 4-4. If these are green, the LEDs indicate the area protected by the light curtain is clear.

If the protected area is not clear, the Status LEDs will turn red. Refer to the Light Curtain Operating Manual which is located in the system documentation storage pocket (See Figure 3-2).

If the light curtain beam is broken before the front access door has completely closed, the welder will halt.


Figure 4–4 Light Curtain Status LEDs
**K AC Utility Outlet**

An AC utility outlet is provided on the front control panel (see Figure 4-2). The duplex outlet is a standard feature and has snap-close covers. For machines intended for use in North America, the outlets are rated at 4 Amps total at 120 Volts AC.

For machines configured for use outside North America, the outlets are wired for the voltage appropriate for use in the intended country of installation. The 4 Amp rating is the maximum combined current that should be drawn from the outlets. The utility outlet has its own circuit breaker in the electrical cabinet. Refer to Figure 10-2 for the location of the AC outlet breaker inside the electrical cabinet.

**L Vacuum On/Off Button**

Vacuum holds parts in place on the upper tool.

This button allows the operator to control the vacuum manually.

Pressing the button turns the vacuum on or off.

This is typically used when setting up the machine, and when making adjustments to part placement.

The feature can be used in Manual or Auto modes. See Figure 6-26 on Page 67.
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SECTION 5

Normal Weld Cycle

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Parts Loaded

Both Parts in Lower Tooling

The most common arrangement places both parts in the lower tooling, with the part designed to mate with the upper tooling placed on top. Some parts are self-aligning, some have small tabs or breakaway pins and sockets. These are ideally suited to be loaded together into the lower tooling.

Upper Part in Upper Tooling

Trying to place two parts that are not self-aligning in the lower tooling in a production environment, can result in crushed parts if they are not accurately positioned. Parts which are not self-aligning or present alignment problems require the upper part to be held in the upper tooling. The upper tooling may have an optional vacuum retention feature to hold the part in place. This configuration is shown in Figure 5-1. The button to activate the vacuum retention is located either in place of the left operate switch or on a separate switch housing next to the right operate switch and reset button.

Initiate Weld Cycle

The operator places parts in the tooling, making sure the light curtain beam is not obstructed. The operator then presses either Opti-Touch operate switch to initiate a weld cycle. The green IN CYCLE indicator ( in Figure 4-1), starts flashing, and the welder executes the currently loaded setup file. Each setup file determines the weld mode, vibration amplitude, weld pressure and contains values for all the required parameters.

Access Door Closes

As soon as the green IN CYCLE indicator starts to flash, the front access door starts to close. As the door slides up, hydraulic pressure causes the lift table to begin rising. During the access door transition, the area protected by the light curtain beam cannot be broken. If this protected area is penetrated before the door closed sensor is activated, the door will immediately stop. To recover from a light curtain fault, press the HOME MACHINE button. Reference Section 8 – Machine Operation, Home Procedure, Page 109.
If the compressed air supply is not turned on, the door will not be able to move. In this case, the lift table will begin to move, but will stop after a short time because the door-open sensor has not been released. Again, the welder will stop and must be reset.

**Clamping Phase**
As the access door begins to close, the lift table rises until it reaches either the preset trigger position or zero motion is achieved (depending on whether trigger-by-position or trigger by zero motion force is selected). This is illustrated in Figure 5-2.

**Welding Phase**
When the table reaches the trigger point, the magnetic drive heads are energized for the programmed time (typically a few seconds) or until the programmed collapse distance is achieved. This is illustrated in Figure 5-3. The drive head vibrates the upper part against the fixed lower part, under relatively high pressure which results in frictional heating. This heating melts the joint surfaces and continues until the melt layer has sufficiently penetrated the material. The frequency of vibration is between 200 and 240 Hz, and the total vibration amplitude can be set to between 0.020 and 0.070 inches (0.5 to 1.8mm). The weld cycle can be set to run for a predetermined time (0.01 to 30.00 seconds) or until a specified collapse distance (0.10 to 8.00mm) is achieved.

**Hold Phase**
After the welding phase is complete, the parts are held together under pressure for the hold time. This allows the molten plastic to fuse together and solidify. Clamping under pressure while the bond hardens also corrects any warping problems by forcing the parts into the proper geometry. The hold pressure is specified separately from the welding pressure to control flash and produce a stronger weld by reducing shear thinning.

---

**NOTE**
Hold time should be no less than half of actual weld time. It is usually best to set hold time equal to weld time.
Release Phase
The lift table now lowers to its starting or load position as illustrated in Figure 5-4. At the same time, the access door begins to open. Again, the area protected by the light curtain cannot be penetrated until the access door is fully open. If the protected area is penetrated during the door transition, the welder will immediately stop and must be reset.

Parts Removed
Once the access door is fully open and the table is at the load position, the IN CYCLE light will stop flashing. Now the assembled part can be removed as illustrated in Figure 5-5. A new set of parts is installed in the tooling, and the weld cycle can be started again.
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## Section 6 - Touch Screen Menus

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_Dukane Manual Part No. 403-582-02_
Introduction

This section of the manual will orient the operator to the touch screen features and to its basic operation.

The information corresponds to the physical orientation of the screen, beginning with the left column of seven menu "buttons". These touch cells are virtual buttons, and we will refer to them as buttons in this manual. These are the primary buttons, used to move through the menus. See Figure 6-1.

RUN MODE will be considered first, then SETUP MODE and so on.

NOTE

A touch screen button is activated with the gentle, firm touch of a finger. When active, the touch cell changes color - in most cases this means from a dark blue to a lighter, brighter blue.
Primary Menu Buttons

Here is an overview of the functions of the seven primary menu buttons:

**Operate:** Monitors process parameters during the cycle.

**Setup Summary:** Displays process parameters being used during a cycle.

**Sensor Status:** Displays the status of all sensors used during a cycle.

**Valve Status:** Displays the status of all programmable valves being used during a cycle.

**I/O Table:** Monitor the PLC inputs and outputs during a cycle.

**Load Position:** Program a table height.

**Trigger Method:** The option to select trigger by position or zero motion.

**Weld:** The option to select weld by time or position.

**Hold:** Program hold time and force.

**Autotune:** Options to Autotune and test run the tool.

**Load Setup:** Options to load setups 1-10 or view setups.

**Save Setup:** Options to save setups 1-10 or view setups.

**Limits:** Set process limits on weld time, force, amplitude and total collapse.

**Tool Options:** Access to part sensors, vacuum options, programmable valves, tool ID, and tool weight compensation options.

**Utilities:** Access to password options, overload settings, table speed, units of measurements, valve monitor and bypass time, edit date and time, multi-language options and save location of part data.

**Door & Table:** Provides controls and status for the door and lift table.

**Home Machine:** A method of bringing the machine to a starting point.

**Part Data:** Shows weld data for every process part.

**Alarms:** Access to alarm messages.

Also see - Table 6-I Alarm Messages, Pages 88-93.
Select a Language

In RUN MODE, using the multilanguage buttons shown below, select a language for the touch screen display.

NOTE

Multilanguage: Language selection can be done in either RUN MODE or SETUP MODE.

Multilanguage Buttons

Multilanguage: Only English and Spanish are supported. Just press the English or Español touch button to toggle between languages.
Run Mode > Operate

Anytime during a machine cycle, Operate, Setup Summary, Sensor Status, Valve Status and I/O Table screens can be accessed without interrupting the cycle.

The Operate screen is used in this example.

Limit Indicators

Black = Start of a new cycle.

Red  = 1. The actual is less than or equal to the minimum limit.
       {Considered a suspect part}

2. The actual is equal to or greater than the maximum limit.
       {Considered a suspect part}

White: = The limit function is off.

Green: = The actual is within the limits.
       {Considered a good part}

See next page for explanations of these weld parameters.

Continued
Run Mode> Operate  

Counter Reset Buttons

Reset Part Counter -
When pressed will set [Part Count] to 0 pcs.
This button can be password protected.

Reset Suspect Part Counter -
When pressed will set [Suspect Part] to 0 pcs.
This button can be password protected.

Part Presence Indicators

There is support for five part presence sensors.

Sensor 3 is dedicated for vacuum but could be used even if there is no vacuum.

A description can be added to help identify location on the tool. If the indicator is green, then the part's presence is detected. If the indicator is red, the machine is waiting for a part to be detected, before allowing a cycle.

These indicators are only visible when sensors are enabled.

Weld Parameters

Weld Time: The amount of time friction is maintained across the work piece.

Total Collapse: Weld and hold distance combined.

Weld Force: The force that is applied across the work piece during the weld time.

Amplitude: The amount of horizontal displacement applied to the work piece during the weld time.

Frequency: The frequency at which the tool runs.

Current Force: The force that is applied across the workpiece.

System Force: The force that the hydraulic system is generating at any given moment.

Table Position: The current position of the table.
Run Mode > Setup Summary

This screen displays process parameters currently in use.

**Figure 6-4**  Run Mode > Setup Summary
Run Mode > Sensor Status

Sensor status provides status for part presence sensors 1 through 5 in the example shown below.

There is support for five part presence sensors.

Sensor 3 is dedicated for vacuum but could be used even if there was no vacuum.

A description can be added to help identify a location on the tool.

If the indicator is **GREEN**, then a part is present

If the indicator is **RED** then the machine is waiting for a part to be placed, before allowing a cycle.

**NOTE**

This screen is viewable during a cycle.

Sensor indicators are only visible when sensors are enabled.
Run Mode > Valve Status

Valve Status provides status for four programmable valves in the example shown below.

**GREEN** indicates that the valve is on.

**RED** indicates that the valve is off.

**NOTE**

Each valve can have a description up to 20 characters in length. This is useful when identifying functionality. Look at the figure below. Each valve has two ports, [A] is used as Extend, Clamp, or Engage and [B] is used as Return, Release, or Disengage.

![Machine ready for cycle](image)

**NOTE**

This screen is viewable during a cycle.
Run Mode > I/O Table

With I/O Table you have access to all input and output cards on the PLC rack. Monitoring of all cards is allowed during a cycle. This becomes useful when you’re trying to troubleshoot sensors or actuators on a tool.

The figures on the next two pages illustrate the PLC card information for slots 1-4.
Run Mode > I/O Table > Slot 1 1769-IQ32

![I/O Table Slot 1 Image]

Figure 6-8  Run Mode > I/O Table > Slot 1

Run Mode > I/O Table > Slot 2 1769-OB32

![I/O Table Slot 2 Image]

Figure 6-9  Run Mode > I/O Table > Slot 2

**Edit Button**

If you decide to add inputs or outputs the edit button provides a method to add a description up to 12 characters in length.
**Run Mode > I/O Table > Slot 3 1769-IF4I and Slot 4 1769-OF4VI**

![Figure 6-10](image)

### Analog Input Card 1769-IF4I Slot 3
- Input Channel 0 [32767]: PLC Amplitude Reference
- Input Channel 1 [32767]: (LPT322) Table Position Sensor
- Input Channel 2 [32767]: Pressure Feedback
- Input Channel 3 [32767]: Drive Voltage Monitor

### Analog Output Card 1769-OF4VI Slot 4
- Output Channel 0 [13419]: Drive Frequency Control
- Output Channel 1 [0]: PLC Amplitude Set Point
- Output Channel 2 [0]: Proportional Relief Valve, Pressure Setup
- Output Channel 3 [0]: Directional Valve Control

**Figure 6-10** Run Mode > I/O Table > Slots 3 and 4
Select a Language

In SETUP MODE, using the multilanguage buttons shown below, select a language for the touch screen display.

NOTE
Multilanguage: Language selection can be done in either RUN MODE or SETUP MODE.

NOTE
Multilanguage: Only English and Spanish are supported. Just press the *English* or *Español* touch button to toggle between languages.

![Multilanguage Buttons](image-url)
Setup Mode > Load Position

**Load Position** - The table height an operator will use to load parts. The table height is programmable between 50mm and 508mm. (1.968 and 20 inches)

**Current Table Position** - The actual position of the table.

- **Table Up** - Lifts the table.
- **Table Down** - Lowers the table.

**Press to Save** - Accepts the current table position as the load position.

**NOTE**
Table will overtravel past the position set in the program. This overtravel is normal and consistent and should be expected.
Setup Mode > Trigger Method

Two trigger methods are supported - **Zero Motion** and **Position**. Depending on which method is selected, only controls related to that method will be visible.

**Trigger by Zero Motion**

**Zero Motion** - Welding starts when the lift table no longer moves. *This is the preferred method of welding.*

![Machine ready for setup](image)

Setup Mode > Trigger Method > Zero Motion

**Set Table Slowdown** - Sets the position the table starts to slow before engaging the work piece. Follow the three steps on the touch screen.

**Table Position**: Current position of the table.

**Trigger Limits** - A way to check if parts are properly loaded or to prevent double welding of a part.

**How to Use** - Place a set of un-welded parts in the tool. Close the tool and read the table position and then set the **Trigger** to the same value. Set the **Min.** and **Max.** to 8mm, and weld a set of good parts.

*Continued*
Setup Mode > Trigger Method

Trigger by Position

Set your **Trigger** so it matches your **Start Position**.
Set the **Min.** and **Max.** values so the machine alarms if the following conditions are detected.

a. Parts not loaded.
b. A welded part is present.
c. No parts loaded.
d. Parts not loaded properly.

Welding starts when the table position is equal to or is greater than the trigger position.

**Trigger Position** - A method of programming a trigger value. The trigger position is programmable between 50mm and 508mm (1.968 and 20 inches).

**Figure 6-14**  Setup Mode > Trigger Method > Position

**Save** - Accepts your table position as your trigger position.
Setup Mode > Weld
There are two weld methods:
Weld by Time and Weld by Distance.

Weld by Time
The figure below illustrates the basic view of the touch screen for weld by time.

- **Segments** - A way of turning on 2 or more segments for profiling. There is a maximum of 5 segments.

- **Weld Amplitude** - The amount of horizontal displacement that’s applied across the work piece. The amplitude range is .5mm to 1.778mm peak to peak.

- **Weld Time** - Maintains friction across the work piece until the weld time has elapsed. The weld time is the sum of all segments that are being used. In this example only 1 segment is used so the weld time is 5 seconds.

- **Profiling** - You’re profiling when 2 or more segments are being used. In this example we are not profiling.

- **Weld Force** - The force that is used during the weld time. The programmable ranges are listed below.
  a. VW4300 [1000-3000 lbs]
  b. VW4500 [1000-4500 lbs]
  c. VW4700 [1000-5000 lbs]
  d. VW4900 [1000-5500 lbs]

- **Escape** - Exits the Screen
Setup Mode > Weld

Weld by Distance

The figure below shows that while welding by distance, profiling is being done with five segments.

**Distance** - A method of programming a distance value. The programmable range is between 0.1mm and 8mm.

**Weld by Distance** - Maintains friction across the work piece until distance is achieved or the weld time has elapsed.

**Weld Time** = Seg 1 + Seg 2 + Seg 3 + Seg 4 + Seg 5

In this example total weld time would be 20 seconds. However, even though 5 segments are active, it may only take 12 seconds (as an example) to achieve the distance. Once distance is achieved, the remaining segments are ignored. If you time out, a Weld Time Limit alarm is triggered.

**How Profiling Works** - Friction is maintained across the work piece using weld parameters in segment 1 for 2 seconds. Then weld parameters in segment 2 are used for 5 seconds and so on. This continues until distance is achieved, or until all active segments are used - whichever happens first.

**Weld Time** maximum value for each segment.

- a. Segment 1 [30 sec. max.]
- b. Segment 2 [10 sec. max.]
- c. Segment 3 [10 sec. max.]
- d. Segment 4 [10 sec. max.]
- e. Segment 5 [10 sec. max.]

![Figure 6-16](image)

Setup Mode > Weld > Weld by Distance
Setup Mode > Hold

The figure below shows an example of the touch screen buttons used for programming a hold.

**Hold Time** - The time that parts are held together after they are welded.

<table>
<thead>
<tr>
<th>Hold Time - Range 0.0 sec. to 30.0 sec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hold Time: 4.000 sec.</td>
</tr>
<tr>
<td>Hold Force: 18.6824 kN.</td>
</tr>
</tbody>
</table>

**Hold Force** - The force used during the hold time. The programmable ranges are listed below.

- a. VW4300 [1000-3000 lbs]
- b. VW4500 [1000-4500 lbs]
- c. VW4700 [1000-5000 lbs]
- d. VW4900 [1000-5500 lbs]
**Setup Mode > Autotune**
*(With Auto-Ping OFF)*

**Autotune** - Use this feature to automatically determine the resonant frequency of the vibrating mass. Frequency range is between 200 Hz and 240 Hz, with a resolution of 0.01 Hz.

The figure below shows an example of the touch screen display after an Autotune has been completed.

**NOTE**

Before performing an Autotune, the upper tool must be installed and free from obstructions.

If Autotune is performed with no upper tool installed, the machine will alarm. This alarm can only be cleared after a successful Autotune is done.

---

**Run Tool** - Use this to test the tool after it has passed an Autotune.

**Tool Frequency** - This is the resonant frequency of the vibrating mass. The welder runs the tool at this frequency.

**Weld Amplitude**
This tests the tool at a different amplitude. Amplitude range is .5mm to 1.778mm peak to peak. *Amplitude is defined as the amount of horizontal displacement.*

**Current Amplitude**
This is a display of current amplitude while the tool is running.

**Message Cell** - One of three messages will display during an Autotune:
1) Autotune Complete;
2) Autotune in Progress; and,
3) Autotune Error (Did not find a resonant frequency between 200 Hz and 240 Hz.)
Setup Mode > Autotune  Continued from previous page
(With Auto-Ping ON)

Auto-Ping - When on, this feature automatically does an autotune after a selected number of cycles are completed. The operator sets the counter with a preset range between 1 and 300 cycles, and monitors machine cycles.

The figure below shows an example of the touch screen display when setting auto-ping.

![Image of touch screen display]

**NOTE**

Why use Auto-Ping?
Under certain conditions, the temperature of some welder parts may vary over time resulting in changes to the resonant frequency of the tool. With auto-ping the welder automatically compensates for these changes by periodically measuring the resonant frequency. It then sets the welder running frequency to match it. Benefits: welder parts run cooler, and there is reduced energy use. This results in lower stresses to welder parts and extends equipment life.

Figure 6-19  Setup Mode > Autotune > Auto-Ping ON

- If the button is set to then Autotune is performed after a cycle is complete.
- If the button is set to then Autotune is performed before the next cycle starts.
User Options Mode

Press the USER OPTIONS button to see the User Options screen. Five features can be accessed:

- Load Setup
- Save Setup
- Limits
- Tool Options, and
- Utilities

Each feature will be introduced with touch screen examples in the pages that follow.

User Options > Load Setup

Press the Load Setup button to see a list of setups.

In the figure below, Setup 2 was loaded into the working memory. *(Up to 10 setups can be stored in memory.)*

Figure 6-20  User Options > Load Setup

View Setups - A way of viewing the content of setups 1 through 10.
User Options > Save Setup

To save a setup:
1. Touch the **Save Setup** button to start the save setup sequence.

2. Select a Destination Setup.
   2a. Press the **Press to Save Current Setup to Destination Setup** button to save the setup.
   2b. Press the **Press to Enter Job Name** button to enter a job name - up to 25 characters in length.
   2c. Select a Job Name Destination.

3. Press the **Press to Save Job Name to Job Name Destination** button to save job name to destination.

See the figure below.

![Figure 6-21 User Options > Save Setup](image)
User Options > View Setup

To view a setup:

1. Press the Setup button under the Select Setup label, and choose a setup.

2. Press the Press to Update button to view the content of the chosen setup.

The figure below shows that Setup 2 is being viewed.

![User Options > View Setup](image_url)
User Options > Limits

The limits screen allows you to set pass/fail conditions on weld parameters.

Minimum Limit

If the parameter's actual value is less than or equal to the minimum limit, this is considered a failing condition or a suspect part. If the parameter's actual value is greater than the minimum limit, this is considered a passing condition.

Maximum Limit

If the parameter's actual value is equal to or greater than the maximum limit, this is considered a failing condition or suspect part. If the parameter's actual value is less than the maximum limit, this is considered a passing condition.

Example Screen

In the figure below, parameters Weld Force and Weld Amplitude are enabled, while Weld Time and Weld Distance are disabled.

NOTE

Weld parameter actual values can be viewed on the Operate screen. See Page 44.
**User Options > Tool Options**

**Tool Options** provide access to options for these components:

- Tool ID,
- Sensors,
- Vacuum,
- Valves, and
- Tool Weight Compensation

**Tool Options > Tool ID**

**Tool ID ON** - The welder will not cycle until a valid tool ID is identified. A valid ID is a value between 1 and 10.

*Example:* If 1 is identified, then Setup 1 is loaded into working memory. Loading or saving to a setup other than 1 is restricted. The only setup you can modify is Setup 1 unless tool ID has been turned off.

**Tool ID OFF** - Tool ID is ignored.

See the figure below.

![Figure 6-24 User Options > Tool Options > Tool ID](image_url)
User Options > Tool Options > Sensors

Your system allows for five sensors. Typically the sensors are "part presence" sensors. With the sensors enabled, the operator can easily check for part placement.

Sensor 3 is reserved for vacuum status.

The figure below shows an example Sensors screen.

**Enable** (green)
Sensor input is noted, and indicators are visible on the Operate screen and on the Sensor Status screen.

**Bypass** (red)
Sensor input is ignored, and indicators are not visible on the Operate screen nor on the Sensor Status screen.

**NOTE**
Reference the system electrical schematics for wiring information.

**Edit Description**
Allows for a description up to 20 characters long.

**NOTE**
Descriptions can be helpful in identifying the location of a sensor on the tool.
User Options > Tool Options > Vacuum Options

Vacuum can be started manually or automatically.

Which method should be used?

Manual
Typically a manual start method is used when vacuum is required on the lower part of the tool.

This is also referred to as bottom loading.

Auto
Typically an auto start is used when vacuum is required on the upper part of the tool.

This is also referred to as top loading.

The figure below shows an example Sensors screen.

**Manual** - Vacuum is turned on by a push button, and turned off at the start of hold time.

**Auto** - Vacuum is turned on when the lift table is in the load position, and turned off during the hold time.

**Vacuum On/Off** Typically used to test vacuum functions.

Figure 6-26  User Options > Tool Options > Vacuum Options
**User Options > Tool Options > Valve**

The valve menu screen allows the operator to program valves. **Programmable valves** are used to control clamp, eject and slide systems on a tool.

The **start method** provides options about when to clamp or extend a device.

The **stop method** provides options about when to unclamp or retract a device.

The figure below shows an example Valve screen.

---

**Selecting Start and Stop Methods**

To select a start or stop method, touch the selection box, and you will see a green border around it. The up and down touch keys will control the pointer inside the selection box. The Enter touch key will accept the selection.

---

**Eject Time**

Use Eject Time to program how much time is needed to maintain the ejector extended and then retracted. For example, if two seconds is selected, the ejector will extend for two seconds and then retract for two seconds. Once the time has elapsed, the valve will be turned off leaving the ejector in a return position.

---

**NOTE**

If you are using sensors to monitor extend and retract positions, then the eject time is not necessary and will not be displayed as an option if the start method is set to Eject.
User Options > Tool Options > Valve

Stop Method Time
The stop timer is used to control the amount of time a device is unclamping or retracting before the valve is turned off.

Valve 1 - Option to add a description up to 20 characters long. An example would be Cavity 1 Clamp. Reference the schematics (found inside the electrical cabinet) to determine Valve 1 location on the manifold.

Port A - When the A side of Valve 1 is energized, air flows out of Port A on the manifold. This means you’re typically clamping a part, extending an ejector or engaging a slide system. You can also add a description up to 20 characters long. An example would be Clamp Part.

Port B - When the B side of Valve 1 is energized, air flows out of Port B on the manifold. This means you’re typically unclamping a part, retracting an ejector or disengaging a slide system. You can also add a description up to 20 characters long. An example would be Unclamp Part.

Sensors - There are dedicated inputs for each programmable valve to monitor extend and retract function of a device. Enable the sensor input by setting it to Monitor; if it is set to Bypass, then sensor inputs are ignored.

Behavior when Sensors are Set to Bypass
There is a timer for each valve that allows an amount of time for a device to complete its task. The default setting for each valve is 1 second.

Example - A cycle has started. The welder will pause 1 second for a device to clamp a part. Then it continues with the cycle.

The timers are called Bypass Sensor Time.
The timers are located at:
User Options>Utilities>Valve Monitor Bypass Time.
The programmable range is between 0.25 and 5 seconds.

Behavior when Sensors are Set to Monitor
There is a timer for each valve that monitors extend and retract sensors. If the sensors are not on before the time has elapsed then an alarm is triggered and the cycle is aborted. The default setting for each valve is 1 second.

Example 1 - A cycle has started, and the clamp sensor is on. The cycle continues until it’s complete.
Example 2 - A cycle has started and the clamp sensor is still off after 1 second. An alarm is triggered, and the cycle is aborted.

These timers are called Monitor Sensor Time.
The timers are located at:
User Options>Utilities>Valve Monitor Bypass Time.
The programmable range is between .25 and 5 seconds.

Sensor Status - These are status indicators for extend and retract sensors.
When the sensor is ON the status indicator changes from red to green.

Test V1A and Test V1B - These are test buttons to exercise the extend and retract functions of a clamp, ejector or slide system on a tool.

NOTE
If you are using sensors to monitor extend and retract positions, then stop method time is not necessary and will not be displayed as an option when sensors are set to monitor.
Part Locators

How to Turn on and Initialize Part Locators:

1. Remove all parts from the tool before turning on part locators.
2. To turn on part locators, select:
   User Options>Tool Options>Valve 1.
3. Select: Part Locators for the start method and Start of Weld for the stop method. Typically part locators are retracted before parts are welded, but you can choose any of the stop method options. (See the NOTE to the right.)
4. Home the machine.
5. Machine is ready to run part locator sequence.

Sequence of Operation:

1. Operator loads housing.
2. Part presence sensor detects the housing.
   Sensor 1 input is dedicated for the housing.
3. Once the operator clears the light curtains, part locators are extended.
4. Operator starts a cycle.
5. Part locators are retracted at Start of Weld, before parts are welded. The operator may choose from other options, as to when part locators will be retracted.
   In this example Start of Weld was chosen.
6. The table and door return to their home position.
   (Door open) & (Table in load position)
7. The operator removes a welded part.
   (See the NOTE to the right.)
8. End of cycle.

**Note**
Part Locators option is only available for Valve 1 start method.

**Note**
Sensor 1 is automatically enabled and maintained until Part Locator is turned off. This input must be used for Part Present, otherwise Part Locator will not work.

**Note**
The operator must obstruct the light curtain when removing a part, otherwise the anti-repeat logic will not reset and the machine will not cycle.
User Options > Tool Options > Tool Weight Compensation

To make adjustments for the weight of the tool, go to the menu screen shown below.

Figure 6-28  User Options Mode > Tool Options > Tool Weight Compensation
User Options > Tool Options > Tool Weight Compensation

Follow these steps for Tool Weight Compensation:

Step 1 - Make sure the light curtains are not obstructed.

Step 2 - Press the **Capture Offset** button.

Step 3 - When the process is complete, home the lift table.

---

**Figure 6-29** Starting Tool Weight Compensation

*Continued from previous page*
User Options > Tool Options > Tool Weight Compensation

Once Tool Weight Compensation is complete, the menu screen will be similar in appearance to the example shown below.

The operator needs to Home the table after the process of compensating for the weight of the tool has been finished.

**Figure 6-30** After Tool Weight Compensation is Complete

- **System Force** - This example shows that system force is at idle pressure.
- **Offset Force** - This example shows that a force of 1333 lbs was needed to move the table and lower the tool.

After tool weight compensation is done, the lift table is no longer in the load position. The operator must Home the lift table.
User Options > Utilities

This Utilities menu screen allows the operator to monitor or program several additional features:

- Password Configuration
- Overload Settings
- Table Speed Options
- Calibrate Position Transducer
- Go To Diagnostics
- View Units in "Metric"
- Valves Monitor Bypass Time
- Edit Date and Time
- Save Location of Part data
- Language Choice - English or Spanish

The figure below shows a typical Utilities screen.

![Utilities Menu Screen](image)
User Options > Utilities > Password Configuration

Password Required
Press the Password Configuration button.

A password is required to access the Password Configuration screen.

Default Password
The default password is the number 1.

Figure 6-32  User Options > Utilities > Password Configuration

Continued
Password protection can be used to protect a variety of screens and counters. Refer to the figure below.

Change Password
Allows you to change the password. The default password is the number 1.
A password can be up to 20 characters.

Enable Passwords
Turns password control on or off.

Password
A password screen pops up asking for a password. Default password is 1. The RUN MODE screen displays after a valid password is entered. Press the HOME MACHINE button to open the door.

No Password:
Press the HOME MACHINE button to open the door.

Maintain door close on suspect part.
Makes the operator acknowledge and perform extra steps to remove a part that has failed one of the process limits. There are two modes of operation - with or without password protection.

Goto PV700 Configuration Mode:
Exits the application and displays options for Panel View Plus 700 terminal settings.
In terminal settings you can configure the time zone, screen saver and IP address.
To return to the vibe welder program, press Run Application.

Button Color
RED = Password protection off.
GREEN = Password protection on.

Change Password:
Used to change current password. A password can be up to 20 characters.
The default password is the number 1.
User Options > Utilities > Overload Settings

Overload settings can be made for these three variables:

**Voltage Delay** - Allows 1 to 3 seconds for the PLC to detect normal operating voltage before Voltage Overload alarm is triggered.

**Feedback Delay** - Allows 1 to 3 seconds for the PLC to detect a feedback signal, before No Feedback Detected alarm is triggered.

**Current Overload** - Allows 1 to 3 seconds for the PLC to detect normal operating current before Current Overload alarm is triggered.
User Options > Utilities > Table Speed Options

The Table Speed Options screen allows the operator to set these parameters:

- Table up and down speeds (in Setup Mode),
- Table position,
- Part clamp speed,
- Table lift force, and
- Tool cart position.

Table Up Speed in Setup - Adjust the table Up speed (how quickly the table travels up) - in Setup Mode only.

Table Down Speed in Setup - Adjust the table Down speed (how quickly the table travels down) - in Setup Mode only.

Part Clamp Speed - Controls the deceleration speed prior to engaging the work piece. Deceleration occurs 50mm before your trigger position or table slow down setting.

Table Lift Force - The force the table uses during Setup mode and In Cycle when weld and hold force are not used.

NOTE
Using a tool cart is a quick and safe way of installing and removing tooling from the lift table.

Tool Cart Position - When the button is pressed, the table travels to the programmed tool cart position.

Figure 6-35  User Options >Utilities > Table Speed Options
User Options > Utilities > Calibrate Position Transducer

With this screen the position transducer can be calibrated.

Calibration Sequence

1. Remove the tool before calibrating.
2. Use table [UP/DN] touch keys to control the table.
3. Lower the table until it stops.
4. While activating the Cycle Start switch closest to you, press the [Lower Limit] touch button to accept that position as 0.0mm.
5. Raise the table until it stops.
6. While activating the Cycle Start switch closest to you, press the [Upper Limit] touch button. Accept that position as 508.00mm.
7. Repeat Steps 3 - 6. Then check calibration.

NOTE
The position transducer was calibrated at the factory and normally will not need to be calibrated again, however calibration would be needed for any replacement transducer.
User Options > Utilities > Edit Date and Time

This Edit Date and Time screen provides a means of changing the date and time.

See the figure below for a view of this screen.

Sequence for Editing Date and Time

1. Use the buttons on the screen to enter:
   - Hour, Minute, Seconds,
   - Year, Month, and Day

2. Press Update when finished.

![Figure 6-37 User Options > Utilities > Edit Date and Time](image-url)
User Options > Utilities > Save Location of Part Data

The standard HMI used with the 4000 Series Linear Vibration Welders is the Allen Bradley PanelView Plus 700.

To collect part data to a compact flash device, the HMI must be upgraded to a PanelView Plus 700CE or to an industrial PC.

![Figure 6-38 User Options >Utilities >Save Location of Part Data](image-url)
Door and Table Control
Press the DOOR & TABLE button.
This screen allows you to control:
  • opening and closing the front door, and
  • positioning of the table.
Select the appropriate touch keys, and move the door or table.

Door Indicators
When the Door Close status indicator is green, the door is closed and the proximity sensor is on. When the indicator is red, the proximity sensor is off and the door is open.

When the Door Open status indicator is green, the door is open and the proximity sensor is on. When the indicator is red, the proximity sensor is off and the door is closed.

Table Position Buttons
Press Table Up or Table Down to control the table position.
Table position is displayed just below the table Up/Down buttons.
Home Machine

When the HOME MACHINE button is pressed, a black banner appears at the top of the screen giving machine status and instructions when necessary.

Homing the machine brings the welder to a starting point.

Banner
Machine status and instructions appear after HOME MACHINE button is pressed.
**Part Data > Part Data Viewer**

Press the PART DATA button.

The Part Data Viewer screen displays data for as many as 10 weld cycles.

When cycle number 11 is run, the first group of 10 cycles is moved - from Part Data Viewer to Part Data History.

**Suspect Cycle**

If there is a ? next to the part count, then the data is questionable.

The cycle is considered suspect. The cycle may have been aborted, or its process parameters were not met, or an alarm occurred.

---

![PART DATA VIEWER](image)

*Figure 6-41  Part Data > Part Data Viewer*
Part Data > Part Data Viewer > Part History

Press PART HISTORY on the PART DATA VIEWER screen.

The PART DATA HISTORY screen displays data for as many as 50 weld cycles. Each page of this history records 10 cycles.

Suspect Cycle
If there is a ? next to the part count, then the data is questionable.

The cycle is considered suspect. The cycle may have been aborted, or its process parameters were not met, or an alarm occurred.

![PART DATA HISTORY](image)

**Clear History**
Press to erase ALL part data.

**Figure 6-42** Part Data > Part Data History
Alarms

Press the ALARMS primary button on the main screen. A screen listing active alarms will be displayed. The figure below illustrates an example active alarm message.

**Alarm Terminology**

**Active Alarms** - Only currently active alarms are displayed. When an alarm becomes inactive, it is removed from the list.

**Alarms** - Shows which alarm has been triggered.

**QTY** - Shows the number of times that the alarm has been active since the last reset.

**Acc Time** - Shows the total amount of time that the alarm has been active since the last reset.

**Message** - Display alarm’s message. Use the UP and DOWN touch keys to step through alarms.

**Reset Alarm** - There are two ways to reset alarms. Either HOME MACHINE or CLEAR ALARM will reset all active alarms. If an alarm reappears immediately after a reset, then there is a problem that needs correcting before a machine cycle is allowed. The alarm message will provide enough information to aid in correcting the problem.

**Alarm History** - Displays the alarm history screen.

---

NOTE

More on terminology: Please refer to Factory Talk View Studio ME (Allen Bradley) documentation.

---

Figure 6-43  Alarms  

manager: Figure 6-43  Alarms  

Continued
**Alarms > Alarm History**

Press ALARM HISTORY on the Alarms screen.

A screen listing alarm history will be displayed.

See the sample screen image below.

---

**Clear History**

Press to erase the alarm history list.

**NOTE**

See the next page for a table showing alarm messages and possible solutions to remedy an alarm condition.

---

**Figure 6-44**

*Alarms > Alarm History*
<table>
<thead>
<tr>
<th>ALARMS</th>
<th>MESSAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto-Tune Error</td>
<td>Did not find a valid tool frequency between 200 and 240Hz. Only an auto-tune will reset alarm.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>- Verify that all 12mm bolts attaching the tool to the machine are installed and torqued to [100 foot pounds].</td>
</tr>
<tr>
<td></td>
<td>- Check that all bolts on the tool are tightened to the manufacturer’s specification.</td>
</tr>
<tr>
<td></td>
<td>- Check the upper tool weight and make sure it’s within range for the machine.</td>
</tr>
<tr>
<td></td>
<td>- VW3300/4300: between 20 - 55 lbs</td>
</tr>
<tr>
<td></td>
<td>- VW3500/4500: between 35 - 90 lbs</td>
</tr>
<tr>
<td></td>
<td>- VW3700/4700: between 90 - 150 lbs</td>
</tr>
<tr>
<td></td>
<td>- VW3900/4900: between 110 - 200 lbs</td>
</tr>
<tr>
<td>Check Frequency Inverter</td>
<td>The inverter has faulted. Use the error code displayed on inverter and reference the manufacturer’s manual for information on cause.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>- Call technical support.</td>
</tr>
<tr>
<td>Check Front Door</td>
<td>A cycle was started but the front door did not move.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>- Check the pressure setting. The valve should not be set lower than 70psi.</td>
</tr>
<tr>
<td>Check Front Door Sensor</td>
<td>The software has detected [door open] and [door close] sensors on at the same time. Check that sensors are functioning properly.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>- Check the wiring.</td>
</tr>
<tr>
<td></td>
<td>- Check that sensors are functioning properly.</td>
</tr>
<tr>
<td></td>
<td>- Check that sensors are secured and free from any obstruction.</td>
</tr>
<tr>
<td>Current Overload</td>
<td>The load has exceeded the drive’s capability.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>- Increase current delay to 3 seconds.</td>
</tr>
<tr>
<td></td>
<td>- Auto-tune the system.</td>
</tr>
<tr>
<td></td>
<td>- Lower weld pressure.</td>
</tr>
<tr>
<td></td>
<td>- Call technical support.</td>
</tr>
<tr>
<td>Cycle Aborted</td>
<td>Light curtains were obstructed during a cycle, or some other fault aborted the cycle.</td>
</tr>
</tbody>
</table>

Table 6-I   Alarms and Messages (Page 1 of 6)
### ALARMS | MESSAGE
--- | ---
E-Stop or Service Door Open | An E-Stop has been pressed or the back service doors are open.
  
  **Solutions:**
  - Clear all “E-STOP” buttons and press the “E-STOP RESET” button.
  - Close back doors.
  - Check E-Stop circuit safety relay.

Frequency Error | During "Auto-Ping" frequency has deviated more than ".5Hz".
  
  **Solutions:**
  - Verify that all 12mm bolts attaching the tool to the machine are installed and torqued to [100 foot pounds].
  - Check that all bolts on the tool are tightened to the manufacturer’s specification.

Front Door Not Closed | Cycle has been aborted, because the front door proximity sensor did not detect anything after 3 seconds of zero motion.
  
  **Solutions:**
  - Check if the sensor is aligned with the target when the door is closed. If not, you may need to make adjustments.
  - Verify you have enough air pressure to close the door. Sometimes you have enough to close the door but not enough to compress the rubber seal. In this situation the sensor's target will be slightly out of its detection range.

Hydraulic Overload | The hydraulic unit is drawing more current than normal, and has tripped the overload relay.
  
  **Solutions:**
  - Check if you have enough oil.
  - Check the power. Reference schematics.
  - Call technical support.

Invalid Tool ID | Tool ID is active but no valid tool ID.
  
  **Solutions:**
  - Check if the tooling supports tool ID. If yes, confirm the cable is connected. If no, then turn off tool ID.
  - Test the cable by performing a point to point continuity test.
  - Reference the schematics.

---

**Table 6-I  Alarms and Messages (Page 2 of 6)**
### ALARMS

<table>
<thead>
<tr>
<th>ALARMS</th>
<th>MESSAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Trigger Limit</td>
<td>Cycle aborted because trigger is higher than maximum trigger limit.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>🔄 Check the parts for proper loading.</td>
</tr>
<tr>
<td></td>
<td>🔄 Check the “Max. Trigger Limit” value; it may be set incorrectly.</td>
</tr>
<tr>
<td></td>
<td>🔄 Check “Trigger Position” value; it may be set incorrectly.</td>
</tr>
<tr>
<td>Minimum Trigger Limit</td>
<td>Cycle aborted because trigger is lower than minimum trigger limit.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>🔄 Check the parts for proper loading.</td>
</tr>
<tr>
<td></td>
<td>🔄 Check the “Min. Trigger Limit” value; it may be set incorrectly.</td>
</tr>
<tr>
<td></td>
<td>🔄 Check “Trigger Position” value, may be set incorrectly.</td>
</tr>
<tr>
<td>No Feedback Detected</td>
<td>The PLC did not detect any amplitude feedback.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>🔄 Increase the feedback delay to 3 seconds.</td>
</tr>
<tr>
<td></td>
<td>🔄 Check your weld force; it could be set too high for the application.</td>
</tr>
<tr>
<td></td>
<td>For example 4000 lbs of weld force could restrict horizontal displacement,</td>
</tr>
<tr>
<td></td>
<td>essentially stalling the machine.</td>
</tr>
<tr>
<td></td>
<td>🔄 Check the tool for proper alignment. If misaligned, the weld bead will</td>
</tr>
<tr>
<td></td>
<td>not have adequate space to move freely causing a stall condition.</td>
</tr>
<tr>
<td></td>
<td>🔄 Check that tool stanchions are in the retract position.</td>
</tr>
<tr>
<td></td>
<td>🔄 Auto-tune the system</td>
</tr>
<tr>
<td></td>
<td>🔄 Verify that all 12mm bolts attaching the tool to the machine are</td>
</tr>
<tr>
<td></td>
<td>installed and torqued to [100 foot pounds].</td>
</tr>
<tr>
<td></td>
<td>🔄 Check that all bolts on the tool are tightened to the manufacturer's</td>
</tr>
<tr>
<td></td>
<td>specification.</td>
</tr>
<tr>
<td></td>
<td>🔄 Check the tool weight and make sure it’s within range for the machine.</td>
</tr>
<tr>
<td></td>
<td>VW3300/4300: between 20 - 55 lbs</td>
</tr>
<tr>
<td></td>
<td>VW3500/4500: between 35 - 90 lbs</td>
</tr>
<tr>
<td></td>
<td>VW3700/4700: between 90 - 150 lbs</td>
</tr>
<tr>
<td></td>
<td>VW3900/4900: between 110 - 200 lbs</td>
</tr>
<tr>
<td>No Hydraulic Pressure</td>
<td>Hydraulic pump is on but no pressure is detected.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>🔄 The pump may be rotating backward, check your power.</td>
</tr>
<tr>
<td></td>
<td>🔄 Check if pressure transducer is providing a signal to analog input card.</td>
</tr>
<tr>
<td></td>
<td>Reference the schematics.</td>
</tr>
</tbody>
</table>

Table 6-I  Alarms and Messages (Page 3 of 6)

Continued
### ALARMS

<table>
<thead>
<tr>
<th>MESSAGE</th>
<th>Description</th>
</tr>
</thead>
</table>
| No or Low Air Pressure | Not enough pressure to close pressure switch. Clear all E-STOPs, press E-STOP RESET, press Clear Alarm, and then check air pressure. Solutions:  
- Is the air line connected to the machine? Reference pneumatic schematic [#18].  
- Is the main air valve that supplies air to the machine, on?  
- Is the “lockout dump valve” open. Reference [#13] on schematic.  
- Clear all “E-STOP” buttons and press the “E-STOP RESET” button. Any time you E-Stop the machine, power is removed from the “start up dump valve”. Reference [#7] on schematic.  
- Check pressure switch setting. Default set point is 70psi. If pressure drops below the set point, the welder will alarm. Reference [#21] on schematic. |
| Process Limit | One of the “actual”readings is not within your process limits. |
| Remove Welded Part | Cycle has been aborted because the welded part was not removed. Solutions:  
- Remove welded part before cycling.  
- Confirm that part presence sensors are working correctly. |
| Sensor Valve 1A Extended | [Valve 1A] has been triggered, but sensor was not acknowledged. Solutions:  
- Check that actuated device is not obstructed.  
- Check the air pressure setting on the valve.  
- Check sensor position; make adjustment if necessary. |
| Sensor Valve 1B Retracted | [Valve 1B] has been triggered, but sensor was not acknowledged. Solutions:  
- Check that actuated device is not obstructed.  
- Check the air pressure setting on the valve.  
- Check sensor position; make adjustment if necessary. |
| Sensor Valve 2A Extended | [Valve 2A] has been triggered, but sensor was not acknowledged. Solutions:  
- Check that actuated device is not obstructed.  
- Check the air pressure setting on the valve.  
- Check sensor position; make adjustment if necessary. |

Table 6-I  Alarms and Messages (Page 4 of 6)
### ALARMS

<table>
<thead>
<tr>
<th>ALARMS</th>
<th>MESSAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor Valve 2B Retracted</td>
<td>[Valve 2B] has been triggered, but sensor was not acknowledged.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>☐  Check that actuated device is not obstructed.</td>
</tr>
<tr>
<td></td>
<td>☐  Check the air pressure setting on the valve.</td>
</tr>
<tr>
<td></td>
<td>☐  Check sensor position; make adjustment if necessary.</td>
</tr>
<tr>
<td>Sensor Valve 3A Extended</td>
<td>[Valve 3A] has been triggered, but sensor was not acknowledged.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>☐  Check that actuated device is not obstructed.</td>
</tr>
<tr>
<td></td>
<td>☐  Check the air pressure setting on the valve.</td>
</tr>
<tr>
<td></td>
<td>☐  Check sensor position; make adjustment if necessary.</td>
</tr>
<tr>
<td>Sensor Valve 3B Retracted</td>
<td>[Valve 3B] has been triggered, but sensor was not acknowledged.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>☐  Check that actuated device is not obstructed.</td>
</tr>
<tr>
<td></td>
<td>☐  Check the air pressure setting on the valve.</td>
</tr>
<tr>
<td></td>
<td>☐  Check sensor position; make adjustment if necessary.</td>
</tr>
<tr>
<td>Sensor Valve 4A Extended</td>
<td>[Valve 4A] has been triggered, but sensor was not acknowledged.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>☐  Check that actuated device is not obstructed.</td>
</tr>
<tr>
<td></td>
<td>☐  Check the air pressure setting on the valve.</td>
</tr>
<tr>
<td></td>
<td>☐  Check sensor position; make adjustment if necessary.</td>
</tr>
<tr>
<td>Sensor Valve 4B Retracted</td>
<td>[Valve 4B] has been triggered, but sensor was not acknowledged.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>☐  Check that actuated device is not obstructed.</td>
</tr>
<tr>
<td></td>
<td>☐  Check the air pressure setting on the valve.</td>
</tr>
<tr>
<td></td>
<td>☐  Check sensor position; make adjustment if necessary.</td>
</tr>
<tr>
<td>Trigger Time Out</td>
<td>Typically occurs when you trigger by position and the table position is less than the trigger position.</td>
</tr>
<tr>
<td></td>
<td>Solution:</td>
</tr>
<tr>
<td></td>
<td>☐  Check the trigger position.</td>
</tr>
</tbody>
</table>

Table 6-I  Alarms and Messages (Page 5 of 6)
### ALARMS

<table>
<thead>
<tr>
<th>ALARMS</th>
<th>MESSAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1 Invalid Combination</td>
<td>Valve 1: Start and stop method cannot be set to &quot;Start of Weld&quot;.</td>
</tr>
<tr>
<td></td>
<td>Solution:</td>
</tr>
<tr>
<td></td>
<td>□ Change your selections for start and stop method so they are not the same.</td>
</tr>
<tr>
<td>V2 Invalid Combination</td>
<td>Valve 2: Start and stop method cannot be set to &quot;Start of Weld&quot;.</td>
</tr>
<tr>
<td></td>
<td>Solution:</td>
</tr>
<tr>
<td></td>
<td>□ Change your selections for start and stop method so they are not the same.</td>
</tr>
<tr>
<td>V3 Invalid Combination</td>
<td>Valve 3: Start and stop method cannot be set to &quot;Start of Weld&quot;.</td>
</tr>
<tr>
<td></td>
<td>Solution:</td>
</tr>
<tr>
<td></td>
<td>□ Change your selections for start and stop method so they are not the same.</td>
</tr>
<tr>
<td>V4 Invalid Combination</td>
<td>Valve 4: Start and stop method cannot be set to &quot;Start of Weld&quot;.</td>
</tr>
<tr>
<td></td>
<td>Solution:</td>
</tr>
<tr>
<td></td>
<td>□ Change your selections for start and stop method so they are not the same.</td>
</tr>
<tr>
<td>Voltage Overload</td>
<td>The load has exceeded the drive's capability.</td>
</tr>
<tr>
<td></td>
<td>Solutions:</td>
</tr>
<tr>
<td></td>
<td>□ Increase the feedback delay to 3 seconds.</td>
</tr>
<tr>
<td></td>
<td>□ Check your weld force; it could be set too high for the application. For example 4000 lbs of weld force could restrict horizontal displacement, essentially stalling the machine.</td>
</tr>
<tr>
<td></td>
<td>□ Check the tool for proper alignment. If misaligned, the weld bead will not have adequate space to move freely, causing a stall condition.</td>
</tr>
<tr>
<td></td>
<td>□ Check that tool stanchions are in the retract position.</td>
</tr>
<tr>
<td></td>
<td>□ Auto-tune the system.</td>
</tr>
<tr>
<td></td>
<td>□ Verify that all 12mm bolts attaching the tool to the machine are installed and torqued to 100 foot pounds.</td>
</tr>
<tr>
<td></td>
<td>□ Check that all bolts on the tool are tightened to the manufacturer's specification.</td>
</tr>
<tr>
<td></td>
<td>□ Check the weight of the tool and make sure it's within range for the machine. WV3300/4300: between 20 - 55 lbs   WV3700/4700: between 90 - 150 lbs WV3500/4500: between 35 - 90 lbs   WV3900/4900: between 110-200 lbs</td>
</tr>
<tr>
<td>Weld Time Limit &quot;has expired&quot;.</td>
<td>Weld time has expired before weld distance could be achieved.</td>
</tr>
</tbody>
</table>

**Table 6-I**  Alarms and Messages (Page 6 of 6)
# Touch Screen Banner

The table below shows all the messages that display in the banner position - at the top of the various touch screen menus.

<table>
<thead>
<tr>
<th>Local Message Display</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm Detected</td>
<td>One or more alarms have been detected.</td>
</tr>
<tr>
<td>Door out of Position</td>
<td>Front door is not in the Home position.</td>
</tr>
<tr>
<td>Ejecting Part</td>
<td>One or more ejectors on a tool are ejecting parts.</td>
</tr>
<tr>
<td>Hydraulics Off</td>
<td>The hydraulic unit is off.</td>
</tr>
<tr>
<td>In Cycle</td>
<td>The machine is in RUN MODE and actively in a cycle.</td>
</tr>
<tr>
<td>Invalid Tool ID</td>
<td>Tool ID is enabled, but an invalid ID was detected.</td>
</tr>
<tr>
<td>Light Curtain is Obstructed</td>
<td>An object has been detected in the detection zone, or light curtains are misaligned.</td>
</tr>
<tr>
<td>Machine Ready for Cycle</td>
<td>Everything is OK and ready for a cycle</td>
</tr>
<tr>
<td>Machine Ready for Setup</td>
<td>Machine is ready for manual operations.</td>
</tr>
<tr>
<td>Remove Welded Part</td>
<td>A part has been processed and waiting to be removed.</td>
</tr>
<tr>
<td>Stanchions Not Retracted</td>
<td>Stanchions are extended and waiting to be retracted.</td>
</tr>
<tr>
<td>System Maintenance Required</td>
<td>Call technical support.</td>
</tr>
<tr>
<td>Table Lock Not Detected</td>
<td>Table lock not in the storage location. Movement of table is restricted. Machine will not cycle until table lock is in position or sensing is bypassed.</td>
</tr>
<tr>
<td>Table Not in Load Position</td>
<td>Table is not in the start position.</td>
</tr>
<tr>
<td>Valve 1: &quot;not retracted&quot;</td>
<td>The retract sensor for Valve 1 is enabled and the device is not in the retract position. Try to Home the machine.</td>
</tr>
<tr>
<td>Valve 2: &quot;not retracted&quot;</td>
<td>The retract sensor for Valve 2 is enabled and the device is not in the retract position. Try to Home the machine.</td>
</tr>
<tr>
<td>Valve 3: &quot;not retracted&quot;</td>
<td>The retract sensor for Valve 3 is enabled and the device is not in the retract position. Try to Home the machine.</td>
</tr>
<tr>
<td>Valve 4: &quot;not retracted&quot;</td>
<td>The retract sensor for Valve 4 is enabled and the device is not in the retract position. Try to Home the machine.</td>
</tr>
<tr>
<td>Waiting for Part and Place Sensors</td>
<td>One or more part presence sensors are enabled but don’t detect the presence of a part. The machine will not cycle until the part is detected.</td>
</tr>
</tbody>
</table>

---

| Table 6-II | Touch Screen Banner Messages |
SECTION 7

Tooling Installation

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Initial Machine Startup

Inspection
Check the hydraulic fluid level to ensure it is at the correct level as shown in Figure 7-1. Refer to Section 3 for specifications on the hydraulic fluid, the fluid cap, strainer and the correct fluid level. Check for any leaks on the floor or under the cabinet. Make sure both the hydraulic system service doors and the electrical cabinet service doors are closed. The hydraulic system service doors are interlocked to prevent machine operation with the doors open. Figure 2-9 shows a typical door interlock device and the mating receptacle in the cabinet.

Apply Power

AC Power
After supplying electrical power to your welder (See Power Requirements, Page 146.), turn on the AC power switch as shown in Figure 3-7.

Machine Air
The welder requires a supply of clean, dry, compressed air at 75 to 90 psi. The connection is made using 1/2 inch O.D. tubing at the pneumatic lockout device. Turn the valve to the right as shown in Figure 7-2 to open the valve and apply the compressed air. The air is used to raise and lower the front access door and for any optional vacuum part–retention or pneumatic clamping and ejection features.

Hydraulic System

Clear Emergency Stop and Reset Welder
Touch the HOME button. The screen will display instructions. A typical sequence is: Reset both Emergency Stop Buttons (E-STOP) by turning clockwise and pulling up. These are shown in Figure 7-3. Clear any alarms. Then press the E-STOP RESET button. The flashing alarm light will go out. If the light does not go out, check the rear service doors. They should be securely closed, and the door interlocks should be engaged.
Activate Hydraulic Pump
To turn on the hydraulic pump, press the green HYDRAULIC PUMP ON push button. It will light when the pump is activated. The RUN screen shows what the lift force is - see Current Force.

See Figure 7-4 for a view of the RUN > Operate screen in both English and metric versions.

Models 4300 and 4500 have a 2-inch bore cylinder whose piston area is 3.14 sq. inches. The hydraulic pressure applied to this area then produces from 440 lbs to 535 lbs of lift force unloaded.

Figure 7-4 shows 755 pounds of lift force at idle.

(These screen images were taken while running a Model 4900 welder.)

Models 4700 and 4900 have a 2.5-inch bore cylinder whose piston area is 4.91 sq. inches. This results in an unloaded lift force between 685 lbs to 835 lbs.

Initiate HOME Procedure
Press the HOME MACHINE button on the left column of the display. See Figure 7-5.

The table will move to its home position, the message will change to MACHINE AT HOME and a message may appear providing status and instructions. Follow the on-screen instructions when those appear.

Press the RUN button to return to the RUN screen.
Install Tooling Assembly

Put the aligned upper and lower tooling assembly on the lift table (the tooling stanchion alignment pins should be extended). Loosely install the lower tooling mounting bolts (M12–1.75) with washers (7/16” Grade 8) into the table. While in SETUP> Load Position (See Figure 7-6), use the TABLE UP control to raise the table until the upper tooling is almost in contact (within 2mm or 0.1 inch) with the spring frame, but not touching.

Position Upper Tooling

Welder Shutdown
Press one (or both) of the E-STOP buttons. The hydraulic pump will stop, its illuminated green light (HYDRAULIC PUMP ON) will go out and the ALARM lamp will flash.

Power Shutdown
Turn off and lockout the AC power. Close and lockout the compressed air. Refer to Figures 2-3, 2-4 and 2-5 for photos of correctly locked–out energy sources.

Mounting Bolts
Loosely install the upper tooling bolts (M12–1.75) with washers (7/16” Grade 8) in the upper spring frame. The bolt patterns for each of the lift tables are shown in Figures 7-7 through 7-10.

Tighten Upper Tooling
1. Turn on the AC power.
2. Apply the compressed air.
3. Clear all the E-STOPs.
4. Press the E-STOP RESET switch.
5. Press HYDRAULIC PUMP ON to turn on the hydraulic pump.
6. Use the Table Up/Table Down (on screen) buttons (See Figure 7-6.) to raise the lift table until the tooling is in direct contact with the spring bridge.
7. Check final alignment of the tooling.
8. Finger tighten all accessible upper and lower mounting bolts.

Figure 7-6  Adjusting Table Height

TOOLING BOLT LENGTH
The M12 x 1.75 bolts used to secure the tooling must have a minimum of three and one-half (3-1/2) threads engaged in the table or spring threads (one times bolt diameter or 6mm). We strongly recommend that the bolts be long enough to engage at least five (5) threads (1-1/2 times bolt diameter or 9mm).
**Figure 7-7**  Model 4300 Upper and Lower Tooling Bolt Patterns
Figure 7-8  Model 4500 Upper and Lower Tooling Bolt Patterns
Figure 7-9  Model 4700 Upper and Lower Tooling Bolt Patterns
Figure 7-10  Model 4900 Upper and Lower Tooling Bolt Patterns
Torque Mounting Bolts

1. Press E-STOP.
2. Disconnect and lockout the AC power.
3. Close and lockout the machine air.
4. Tighten the upper tooling to the spring bridge with a torque wrench to 100 ft-lbs.
   **NOTE:** 100 ft-lbs = 13.83 Kg-m = 136 Nt-m
5. Tighten the lower tooling bolts to the table with a torque wrench set to 100 ft-lbs.
6. Attach and secure any air lines or sensor wiring to the tooling.

Final Tooling Prep

1. Turn on the AC power.
2. Apply the compressed air.
3. Clear any E-STOP.
4. Press the E-STOP RESET button.
5. Press the HYDRAULIC PUMP ON push button.
6. Load the program for the currently installed tooling. Refer to Figure 6-20 and Section 8 - Machine Operation, Selecting a Setup File.
7. Initiate a HOME MACHINE procedure.
   See Figure 7–5.
8. Retract tooling stanchion alignment pins. See Figure 7–11.
9. Remove any protective parts from tooling.
10. Install any mounting bolts that were inaccessible with the tool closed. Torque them to 100 ft-lbs.

Tune Drive to Tooling

During the Autotune process, the machine seeks the operating frequency that optimizes the drive to the load presented by the upper tooling assembly. If an autotune is not performed, the drive will be fighting the natural resonance of the tooling. The results: wasted energy and possible inferior welding.

Continued
Continued from previous page

This wasted energy shows up as excessive heating, usually in the magnetic drive coils. Overheated coils will fail prematurely resulting in unnecessary downtime and expense.

Use all the bolts, torqued to the specified value, to attach the upper tooling, unless some part of the tooling obstructs a hole. Failure to install all the mounting bolts may result in the upper tooling becoming acoustically decoupled from the springs, possibly resulting in damage to the tooling or machine.

Acoustic coupling is the tendency for a multipart mass to vibrate as if it were one piece. Insufficient or loose bolts can cause acoustic decoupling where part of a piece vibrates at a different frequency or out of phase relative to the other pieces. A loose lower tool assembly will result in poor welding and can also cause damage to the tooling or the welder.

1. Perform the Autotune procedure. Refer to Figures 6-18 and 6-19 on Pages 59 and 60.
2. Run Autotune each time tooling is changed. Refer to Section – 10 Troubleshooting if the Autotune procedure fails.
3. After Autotune is complete, go to RUN mode.
5. Press E-STOP RESET.
6. Follow any other on screen instructions.
7. The display should indicate: Machine ready for cycle.
8. The welder is now ready to load parts and begin welding.
Machine Operation

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Machine Startup

A detailed startup procedure is given at the beginning of Section 7 – Tooling Installation. A condensed five step version is given here for your convenience.

1. **AC Power**
   Plug in the AC power cord to a 480 Volt AC, 3-Phase, 30 Amp receptacle and turn on the AC power switch. The yellow MAIN POWER light will illuminate.

2. **Compressed Air**
   Connect the welder to a supply of clean, dry, compressed air at 75 to 90 psi. Turn the lockout valve to the right to open the valve. The air is used to raise and lower the front access door and for any optional vacuum part-retention or pneumatic clamping and ejection features.

3. **E-STOPS & Reset**
   Reset both of the E-STOP buttons by turning clockwise and pulling out (or up). Then press the E-STOP RESET button and the ALARM light will stop flashing and go out. If the alarm light does not go out, make sure the rear service doors are securely closed and the interlocks engaged.

4. **Hydraulic Pump**
   Turn on the hydraulic pump - refer to Figure 8-4 - by pressing the HYDRAULIC PUMP ON button. It will illuminate green when the pump is activated.

5. **HOME Procedure**
   Press the HOME MACHINE button on the left column of the display. See Figure 8-1.

   The table will move to its home position, the message will change to MACHINE AT HOME and a message may appear providing status and instructions. Follow the on-screen instructions when those appear.

   Press the RUN button to return to the RUN screen.

---

**WARNING**

Never operate the vibration welder with any of the service doors open. This is an unsafe practice and can result in injury or death.

The rear service doors also serve as acoustic shields.

---

Figure 8-1   HOME Procedure Screen
Selecting a Setup File

Load an Existing File

Instructions for loading an existing setup file are given in Section 6 – Touch Screen Menus on Page 61 - USER OPTIONS MODE > Load Setup. These steps review that information.

1. Press the USER OPTIONS button and then press the Load Setup button.

2. The Load Setup screen, shown in Figure 8-2, appears. From here you can choose the desired setup file by using the UP and DOWN arrow buttons.

3. When the pointer is next to the desired setup, press the key to highlight it, and load it.

The name of the loaded setup appears just above the list of setups:

Example: Setup 3: Interior Left

3a. To examine the parameter values of a setup file before loading it, press the Setup: button under the Select Setup label. A virtual keypad appears.

Key in the number of the file you want, and press the key.

3b. Press the Press to Update button, and parameters of the selected file will fill the screen.

3c. Figure 8-3 shows that Setup 2 is being viewed.

Programming a New File

Detailed instructions for setting up a new file are given in Section 6 – Touch Screen Menus, SETUP Mode which begins with Figure 6-12, Page 53.

Set Limits

Instructions for setting limits are given in Refer to Figure 6-23, Page 64.
Starting A Weld Cycle

1. **Load Parts In Tooling**
   Once the parts are loaded into the tooling fixtures, and the light curtains are not obstructed, the message banner on the touch screen display should read: Machine ready for cycle.

   **Self–Aligning Parts**
   Upper and lower parts which are self–aligning (e.g. have pins or grooves to keep them aligned) can be loaded together into the bottom tooling fixture.

   **Vacuum Part Retention**
   Parts which are not self–aligning will have to be placed into their respective tooling. The lower part is held in place by gravity. The upper part is placed in the fixture. Use the manual VACUUM ON/OFF button to turn the vacuum on and off as needed.

2. **Control Panel Lamps**
   Check that the green **IN CYCLE** lamp is lit.

3. **Touch Screen Banner**
   Check the banner area at the top of the screen for any messages, and follow any instructions displayed.

4. **Activate Operate Switch**
   Press either of the operate switches to start a cycle.
   
   The front access door closes, the parts are welded and the door opens.

5. **Remove Parts**
   Remove the assembled parts, and repeat the cycle.
Stopping the Weld Cycle

E–STOP Buttons
To stop a weld cycle, press one of the two E–STOP buttons. The welder stops immediately and the hydraulic pump stops. The green HYDRAULIC PUMP ON light and the green IN CYCLE light will both go out, and the red ALARM lamp will flash.

Light Curtain
You can also stop the weld cycle while the front access door is in motion by interrupting the light curtain. This will immediately abort the cycle. The ALARM light will also be flashing.

Resetting Machine
Stopping the welder by interrupting the light curtain or by pressing either of the E–STOP buttons halts all operations and de-energizes the lift table, drive heads and front access door.

To reset the welder, press the HOME MACHINE button on the touch screen.

The operator follows any instructions that are displayed in the banner at the top of the touch screen.

The operator will most likely need to follow these steps:

1. Clear all E-STOPs.
2. Press the E-STOP RESET button.
3. Restart the hydraulic pump.
5. Press and hold the HOME MACHINE button.
## SECTION 9

### Optimizing Performance

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Welding Parameters

Five key parameters that affect weld quality are:

- Frequency
- Time
- Melt Penetration
- Amplitude
- Force

Frequency is adjusted automatically by the system during the Autotune process. Weld time is a trade off between fast cycle times and deep melt penetration. A deeper melt penetration increases weld strength.

Weld Phases - See the explanation at right. The four phases are depicted graphically in Figure 9-1.

The amplitude and force determine how quickly the weld phases progress. These in turn are determined by the type of plastic and the part geometry. With welding parameters held constant, cycle time increases with wall thickness.

Weld Time

The strongest welds are produced using the longest weld time because this allows the melt flow to penetrate deeper into the parts and eliminates any voids.

Weld Distance

Depending on the part configuration, the material displaced will generally range from 0.75mm to 1.25mm (0.019 to 0.032 inch). This is only a broad estimate, and your application may require a different value. The amount of displacement required is affected by the flatness of the welding interface.

With greater warpage, more material needs to be displaced, and the weld cycle will be longer. The strength of the weld can be a function of the weld distance for some thermoplastics and relatively insignificant for others as shown in Figure 9-3. Do not confuse weld distance which is the collapse distance with weld penetration which is how deep the melt flow penetrates.
Weld Amplitude

Amplitude has less effect upon the weld strength than weld time. Figure 9-2 shows the relationship of weld strength for generic POM as a function of weld force for a fixed weld depth and two different amplitudes. Higher weld strength occurs at lower clamping pressures because the weld time is longer and the penetration distance greater. However, as clamping pressure increases to shorten the weld time, the weld strength decreases more rapidly for the low amplitude weld joint. Figure 9-3 shows the relationship of weld strength of different thermoplastics as a function of weld depth (collapse distance) for a fixed weld amplitude and weld pressure.

Weld Force

Increasing the weld force increases the collapse but not the weld penetration. The welding force required for different materials is determined by a combination of the polymer’s melt flow index, the glass transition or crystallization temperature and molecular weight. The approximate melt index range for some common thermoplastics and their welding pressure range are given in Table 9-I. Since there is such a wide range of melt flow rates for even common polymers, depending upon their molecular structure, the welding pressure required can initially only be estimated. The optimal values must be determined experimentally.

Pressure is force per unit area, so the weld force setting is the desired welding pressure multiplied by the total effective joint area. Remember to keep the units of measurement consistent (pounds and inch$^2$, Megapascals or newtons and meter$^2$) when calculating the desired weld pressure.

Hold Force

Clamping under pressure while the bond hardens, corrects warping problems by forcing the parts into the proper geometry. Decreasing the welding pressure at the beginning of the hold cycle can reduce the flow of molten material and thus reduce the size of the weld bead or flash. In addition, this can reduce shear thinning to create stronger welds. The hold time must be long enough however, so that the temperature of the weld seam is below the glass transition or crystallization temperature. A holding time of between one and five seconds is usually enough.
Hydraulic Flow
There are no mechanical adjustments for the hydraulic system. Hydraulic pressure is controlled by the WELD FORCE and HOLD FORCE settings in the setup file. A pressure transducer provides constant feedback to ensure proper control. Figure 9-4 identifies the transducer and control valves. Do not attempt to perform any mechanical adjustments to the hydraulic system.

Pneumatic Pressure
Compressed air is used to raise and lower the front safety door, provide vacuum part retention and actuate any optional pneumatic clamping or ejection features. As long as the air pressure is within the specified range of 75 to 90 psi, the regulator should never require any adjustment. If the pneumatically operated mechanisms are operating too slowly, check that you do not have a restriction upstream and that there is enough air flow into the welder.

Pneumatic Flow
The front safety access door uses compressed air to raise and lower the door. The flow rate of the air controls the speed of the door. These are set at the factory for fast enough operation yet slow enough to avoid slamming the door into the stops. Excessive door speed can result in damage. If they ever require adjustment, loosen the locking rings and make small changes to the flow control. Turn the locking rings back down to prevent changes in the settings. The door flow control valves are identified in Figure 9-5. They are also labeled on the top of the distribution manifold.
SECTION 10

Troubleshooting

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Electronics Control
PLC Backup Battery

Check the status of the BATT LED. This is found inside the electrical service cabinet. See Figure 10-2 on the next page for locations of major electrical cabinet components. The LED is on the PLC.

See Figure 10-1 for backup battery details.

If the LED is off, the battery supports PLC memory.

If the LED is red, only approximately 5% of battery life remains. The battery should be replaced.

If you do not have a spare battery and want to keep your setup files, you will have to leave the AC power on until the battery is replaced.

The first step in preventing data loss is to always have a written copy of your setup files. The second step is to have a spare battery on hand. (Allen Bradley specifies a 1769-BA for the CompactLogix L32 control module).

To replace the battery:

Make sure you are properly grounded before removing the PLC from the rack, or before working on the PLC. This will prevent static discharge and potential damage to the PLC.

1. Turn off the AC power before opening the electrical service cabinet.
2. Figure 10-1 shows where the battery is located.
3. Remove the rack spacer, and then slide the end cover away from the rack. The small cylindrical battery is on the inside of this cover. Remove the old battery.
4. Install a replacement battery, and reassemble the cover and rack spacer.

Each battery contains some lithium. Do not incinerate or dispose of lithium batteries in general trash collection. Explosion or violent rupture is possible.

The lithium material may be considered toxic, reactive or corrosive. The person disposing of the material is responsible for any hazard created in doing so. State and local regulations may exist regarding the disposal of these materials.
Figure 10-2  Interior of Electrical Cabinet with Major Components Identified

- PLC and I/O Modules
- Touch Screen Display
- AC Fuses and Disconnect
- Cabinet Air Exhaust
- System Documentation
- AC Utility Outlets
- AC Outlet Breaker
- Hydraulic Pump Breaker
- Low Voltage Power Supply
- Cabinet Air Intake (Cooling Fan)
PLC Programming Key

We recommend that the key on the front of the PLC module should be in the **RUN** position (at the 10 o’clock position) for normal welder operation.

If the key is in the **PROG** position at 2 o’clock, the PLC will not run.

If the key is in the **REM** position at 12 o’clock, the system should run fine. However, we recommend operating the welder with the key in the **RUN** position.

PLC Status LEDs

The location of the LEDs is shown in Figure 10-3. To interpret these LEDs on your PLC, please read the literature from the PLC’s manufacturer that came with your welding system.

NOTE

Please refer to the PLC manufacturer’s literature that came with your system for information about the PLC status LEDs.
Electrical Power

Internal Fuses
Detail of the electrical cabinet interior is shown in Figure 10-4. Inside the electrical cabinet below the base of the AC disconnect switch is a fuse block containing three 25 Amp fuses. These are wired in series between the AC disconnect switch and the terminal block. To gain access to the fuses, pinch the top and bottom of the clear cover as shown in Figure 10-4, and pull the cover off. There are four locking tabs that must be released which are identified in Figure 10-5. Each fuse has its own red removal tab. Pull the tab to remove the fuse. Note that the fuses are asymmetrical and have a flanged lip on the bottom.

Circuit Breaker
The AC utility outlet on the front panel (K in Figure 4-2, Page 29), is protected by a circuit breaker which is identified in Figure 10-2. The maximum current that can be safely drawn from the utility outlets is 4 Amps total, independent of whether the outlets are wired for 110 Volts AC or 220 Volts AC.

Alarm Messages

Hydraulic Overload
If the circuit breaker for the hydraulic pump motor (Figure 10-6) trips, the touch screen display will show Alarm Detected in the banner position. See Figure 10-7.

Press ALARMS. The alarm will read HYDRAULIC OVERLOAD. The pump motor has overloaded. Try to determine the cause of the overload before resetting the breaker.

1. Check that the hydraulic fluid is clear (not cloudy or dark) with a slight yellow tint. The fluid level sight glass should be at 50%.
2. Verify that the suction gauge (See Figure 3-12, Page 23.) needle is in the safe (green) area when the pump is running.
3. Unscrew the filler cap (Figure 11-3). Pull the base-

Figure 10-4 480VAC Fuse Block

Figure 10-5 480VAC Fuse Block and Removal Tabs

Continued
Continued from previous page

ket and filter and check for any blockage or foreign material.

4. Verify that the heat exchanger is cooling properly, and the hydraulic fluid is below 150°F.

5. Check for any leaking hydraulic fluid from the hose fittings on the floor of the cabinet and underneath the welder.

If the cause of the overload is determined to be one of the five items above, do not operate the machine until the problem has been corrected. Do not increase the trip point on the circuit breaker as this may burn out the pump motor. The motor is designed to draw 4.3 Amps at 480 VAC when delivering its rated 3 HP.

Drive Alarms
If you get a drive related alarm message, check that the tooling is securely attached to the upper frame using all the bolts and torqued to specifications. Check that the weight of the upper tooling is within the specified range:

- Model 4300 20 – 55 lbs (9 - 25 kg)
- Model 4500 45 – 90 lbs (20 - 41 kg)
- Model 4700 90 – 150 lbs (41 - 68 kg)
- Model 4900 110 – 200 lbs (50 - 91 kg)

Refer to Table 6-I ALARMS, Page 89, Hydraulic Overload. The four possible error messages relating to a drive overload are:

1. CHECK FREQUENCY INVERTER
2. FREQUENCY ERROR
3. CURRENT OVERLOAD
4. VOLTAGE OVERLOAD

If the upper tooling is in the correct weight range and is torqued to the proper values, you may need to increase the voltage, current or feedback delay.

Increase the value that corresponds to the error message. We strongly recommend that you consult Dukane prior to changing these values.

Refer to Overload Settings, and Figure 6-31, Page 74.
Hydraulics
Lift Table Moves Too Slowly

1. Check that the weld pressure is not set too low. It must be greater than the table weight, lower tooling weight and static table friction load.

2. Check that the hold pressure is not set too low.

3. Check that the table lift force is not set too low.

4. Check that the hydraulic pressure is correct by verifying that the Current Force on the RUN > OPERATE screen (Figure 6-3, Page 44) is between approximately 440 and 580 lbs for Models 4300/4500, and between about 680 and 850 pounds for Models 4700/4900.

Lift Table Will Not Move

1. Check that the hydraulic pump is turned on.

   The HYDRAULIC PUMP ON light will be lit green and the Current Force on the RUN > OPERATE screen should be within the normal unloaded range.

2. If the hydraulic pump will not turn on, check that the hydraulic breaker is not tripped. See Figure 10-6 for the breaker location and Figure 10-8 for the normal operational settings.

3. Is the hydraulic pump motor rotating in the wrong direction? If the RUN > OPERATE screen indicates almost zero lift force (Current Force) when the pump is on, check that your 480 Volt AC, 3-Phase line is correctly wired. If any of the phases leads are switched, the pump motor will rotate backwards.

   The welder has built-in diagnostics, and the RUN > OPERATE screen will display an error message indicating No Hydraulic Pressure as shown in Figure 10-9. Refer to Table 6-I, Page 90.

   The welders are checked with a phase meter during assembly to ensure the phases are wired correctly and the pump is rotating in the proper direction. The polyphase pump motor is bidirectional and proper rotation can be established by reversing two power leads. To correct the problem, have an electrician swap any two of the high voltage power leads feeding power to the main breaker of the welder.

4. Check that the fluid level in the sight glass is
Continued from previous page

50%. The fluid should be clear (not cloudy or dark) with a slight yellow tint.

5. If none of these actions correct the problem, there may be something wrong with your hydraulic unit.

**Common FAQs**

1. Q: Do I need to service the hydraulic unit?
   A: Yes, but thankfully not that often. You should replace the filter every one to two years, and change the fluid every (or at most every other) filter replacement, depending on the total operational hours on the hydraulic unit.

2. Q: The pump makes noise and a crackle sound. What is causing this?
   A: Pump noise and crackle is most often caused by air entering the pump suction fitting. Tightening the suction fitting (Figure 10-10) will usually eliminate such problems. If the pump fails to prime, vent the pump discharge to atmosphere to reestablish fluid flow.

3. Q: What should I do with the eight grease zerks on the machine?
   A: We recommend you grease the zerks once or twice a year (in severe environments you might want to do it more often) with a good general-purpose industrial grease.

4. Q: An alarm message says: E- STOP OR SERVICE DOOR OPEN. I’ve checked all the doors and cleared the E-STOPs and it still won’t clear, and I can’t run a cycle. What is the problem?
   A: If your machine is equipped with a E-STOP RESET button, you have to push the E-STOP RESET button to reset the safety circuit. If this does not clear the problem, it is possible that one of the E-STOPs or door interlock switches needs replacement.

---

**Figure 10-10** Hydraulic Suction Fitting
5. Q: There’s a red box that says SENSOR 1 (or SENSOR 2) on my screen and it won’t go away, and I can’t run a cycle. What do I do now?
A: If you are using part-in-place detection, the part-in-place sensor is not detecting a part loaded into the tooling. If there are no part-in-place sensors in your tooling, go to the USER OPTIONS > Tool Options > Sensors. Put the sensors in BYPASS mode.

6. Q: What does it mean when I get an Autotune Error?
A: There is either a serious problem with the machine, there is some decoupling occurring between the machine and tool or within the upper tool or, more likely, the upper tool is outside of the weight range of the machine.

7. Q: There are a lot of tooling bolts. How many do I really HAVE to install?
A: The best answer to that question is ALL of them. There are some cases where you can use fewer. The only legitimate reason for not using all of the bolts is that some part of the tooling obscures some of the holes. You must also torque the bolts to 100 foot-pounds (136 Nt-m). If you do not, the upper tool can become decoupled from the springs, resulting in possible damage to the tool or machine. Similarly, a loose lower tool will result in poor welding and can damage the tooling or machine.

8. Q: What do you mean by acoustically coupled?
A: Acoustic coupling is a term we use to describe the tendency of a multipart mass to vibrate as though it were one piece. If the upper vibration tool has some loose bolts in it, the individual pieces can vibrate relative to each other, which causes significant problems. The tooling is then said to be decoupled from the springs. Both the machine and tooling can be damaged if this condition exists for a prolonged period.

9. Q: Why do I have to Autotune the tooling?
A: 1. During an Autotune the machine seeks the optimal operating frequency for that particular upper tool/spring assembly. If an Autotune procedure is not done, the machine will be fighting the natural resonance of the tooling/frame assembly, which may result in poor and/or inconsistent weld quality.
A: 2. Fighting the natural resonance of the tooling/frame assembly results in wasted energy. Since you cannot create or destroy energy, only change its form, this wasted energy shows up as heat, especially in the coils. Overheated coils will fail prematurely, resulting in unnecessary downtime and expense.

10. Q: The machine has two cycle activation switches, so why do I only have to activate one to start a cycle?
A: Machines equipped with light curtains are not required to be equipped with two-hand anti-tie-down cycle actuation, so as a convenience we allow the operator to use either of the switches to start the cycle.

11. Q: This machine is much louder than 80db. What can I do about it?
A: If the machine is slightly louder than 80db, it is probably running an application with a higher basic sound level than we tested the machine for in our factory. If you buy a Dukane machine with tooling, we always check the total noise of the machine and tooling together. Our standard sound insulation package is designed to deal with the majority of vibration welding applications. Consult Dukane about the possible addition of custom sound insulation. If the machine is significantly louder than 80db, you probably have not installed the fork tube covers that came with the machine (Figures 3-4 and 3-5, Pages 18 and 19). When we ship a machine, the covers are shipped in a corrugated box in the bottom of the electrical cabinet.
12. Q: When I push the test button on the Autotune screen (Figure 6-18, Page 59), what am I supposed to hear?
A: You should hear a loud, clear, single-note tone similar to that of a boat horn. If you hear any raspy or buzzing sounds, or if you hear anything like a wow or wow-wow-wow sound, check the security of ALL bolts and other fasteners in the upper tool, including the ones securing it to the springs. If the strange sound persists, call Dukane and ask us to listen to it over the telephone.

13. Q: I’ve installed a tool, done the Autotune, the touch screen indicates everything is OK, but when I push the operate switch to start a cycle, the machine just sits there. What is the problem?
A: You have probably not connected the machine to an air line. The only part of the machine itself that needs pressurized air is the sliding door.

14. Q: Why do I have to reset the machine every cycle, or quite often?
A: The most common cause of this is the operator breaking the light curtain just prior to the sliding door becoming completely open. Make sure the door has lowered completely before breaking the light curtain.

15. Q: When I try to Autotune the machine nothing happens and then after a period of time I get an Autotune error. What is the problem?
A: Press the HOME MACHINE button on the touch screen display, and follow instructions on the message banner. Refer to Figure 7-5, Page 98.

16. Q: What happens if I accidentally run a cycle with the stanchion pins extended?
A: Hopefully nothing. The stanchion assemblies might survive a couple of cycles with the pins extended, but they are not necessarily designed to resist damage in this condition. You could damage the tooling or the machine if you do this. Get into the habit of retracting the stanchion pins immediately upon setting down the wrench after tightening the tooling bolts. Also, habitually looking specifically for retracted stanchion pins prior to initiating the Autotune sequence and prior to initiating the first cycle with a freshly installed tool will give you two more chances to discover extended stanchion pins before you risk damage by cycling the machine with the pins extended.

17. Q: What happens if I accidentally cycle the machine with no parts in the tooling?
A: That depends to a large extent on the construction of the tooling. All production-ready Dukane tools have stanchions that act as stops to prevent the tool being damaged if the machine is cycled with no parts in the tool. We cannot always construct the tool such that it would not be damaged if some part of the assembly is in the tool and some part is not. We see many tools built by others that have no form of safety stops at all, and would be destroyed if this were to occur.

18. Q: The lift table surface and/or springs of the machine are starting to rust. What should I do?
A: Do not scrape or abrade the surfaces in an attempt to remove the rust. Spray the springs and lift table surface with a water displacement solvent like WD–40 or a corrosion protector like LPS–2 to prevent further damage. If you are in an environment where caustics are present, or where it is very humid, you should do this as regularly as you would with any bare steel surface. If the problem is severe and/or persistent, try LPS–3 corrosion inhibitor or contact Dukane.

19. Q: It is a problem that the coils are getting hot?
A: Yes. The bottom surface of the coils should not be too hot to touch. It probably indicates that the machine has not been Autotuned, the upper tool is outside of the weight range for the machine, or there is something loose in the upper tool. If you have checked all of these issues and the problem persists, contact Dukane.
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SECTION 11

Maintenance

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Touch Screen Display
Do not use any solvents or abrasive cleaners on the front panel. Do not spray cleaner directly onto the front panel. Apply a small amount of computer cleaner to a soft towel first. Clean the panel with the moistened towel. Do not allow any liquid to collect around any of the nearby switches.

Pneumatic System
Compressed Air Filter
Under normal operating conditions, the filter (5 micron element) should only need to be replaced every two years or when the pressure drop exceeds 15psi (0.1MPa) whichever comes first. Replacement filters are available from SMC Corporation of America (Part No. AF30P–060S). Before attempting to replace the filter, turn off the compressed air supply, and then disconnect the air supply from the filter inlet. The metal canister and polycarbonate bowl must be removed to gain access to the filter element. Carefully remove the water drain line from the bottom of the housing before removing the filter canister. The hose fitting can be easily snapped off if bent to far.

To remove the canister, pull and hold the spring-loaded black release tab down as shown in Figure 11-1. Turn the canister 45° either to the left or right, then pull straight down. The filter element is installed under the regulator housing. Twist the filter retainer 90° (Figure 11-2) and pull it down to remove the filter. Install a new filter element and replace the retainer. Reinstall the filter canister by holding the black release tab down and inserting the housing vertically, but rotated 45° off center. Still holding the spring-loaded tab down, push the canister up as far as it will go. Turn the canister 45° until the locking tab is under the alignment mark. Release the tab and it will click into the locked position. Carefully reinstall the water drain hose.

Moisture Trap
The metal cage below the pressure gauge covers the polycarbonate moisture trap. The trap features a normally closed float and is self-draining of accumulated water. A drain hose is attached to the bottom of the filter housing which exits at the bottom of the machine.

CAUTION
Never use anything sharp on the touch screen. Only use your finger. The screen is intended for industrial use, but can be damaged by scratching or puncturing. Use only a damp (not wet), soft cloth to clean the display. Never spray any liquid directly on the screen. Do not attempt to clean the screen with any solvents.

WARNING
Never attempt to remove the filter housing while the compressed air is on. Turn off the compressed air supply, and disconnect the air line from the filter inlet.
Keep this in mind as moisture draining to the floor could cause a problem. The total drain line length should be less then 16.5 ft (5 m). The internal float will open under pressure above 22 psi (0.15 MPa) when approximately 25 cm³ = 25 ml (0.85 ounce) of water has accumulated.

**Hydraulic System**

**Hydraulic Pressure**
The pump is set to deliver up to 1500psi at a maximum operating temperature of 150° F. After an extended period of use, the hydraulic reservoir, pump, motor and heat exchanger can become very hot. Use caution to avoid burning yourself. Let the unit cool down to a safe temperature before attempting any maintenance or adjustments.

**Hydraulic Fluid Level**
The reservoir has a capacity of 20 U.S. gallons or 75.7 liters. Maintain the fluid level to appear at the center of the sight gauge. This corresponds to about 18.5 gallons or 70 liters. If you have to add fluid after use, you obviously have a leak somewhere. Do not operate the machine until the hydraulic leak has been identified and repaired.

**Hydraulic Fluid Change**
Under light to normal operating conditions, the fluid should be changed every four years or 10,000 operational hours, whichever occurs first. If the fluid starts to darken or appear cloudy, it should be changed immediately. Deteriorated hydraulic fluid reduces component life and is a potential danger to operating personnel. Hydraulic fluid is not expensive, and fresh fluid is good insurance against having to replace a costly hydraulic pump.

To drain the hydraulic fluid, unscrew the filler cap shown in Figure 11-3 and remove the filter element and basket. Use a hand pump or electric pump inserted into the filler opening to empty the fluid into a safe storage container. Do not use the drain plug at the bottom of the reservoir. This will create a mess of used hydraulic fluid in the floor of the cabinet because the drain plug does not have a shut-off valve.

After draining the reservoir, some fluid will remain in

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*Continued from previous page*
the hydraulic cylinder and lines, so it will take less than 18.5 gallons to refill. Add new fluid until level in the sight glass is at 50% (Figure 11-4). Again it is best to use a pump to fill the reservoir to prevent spillage. We also recommend filtering the fresh fluid to avoid the possibility of any contaminants entering the hydraulic system. You may want to attach a high capacity filter to your pump to speed up the process.

We prefer Mobil DTE® 25 hydraulic fluid because it has a higher temperature breakdown rating. There is very little price difference, and the cost of replacing components in the hydraulic system dictates good maintenance procedures and quality fluid.

When the fluid is changed, install a new filter element. Contact Flodyne/Hydradyne Inc, Hanover Park, IL 60103 USA, (630) 563–5468. The replacement element is Part No. 0075R010BN3HC. After refilling the reservoir, place the new filter in the basket and reinstall them. Screw the filler cap back on making sure the O–ring seats properly. Tighten the cap securely using a wrench to create a positive seal around the O–ring and prevent any fluid leaks. After the system has been cycled a few times, recheck the fluid level. It may be necessary to add more hydraulic fluid if the sight–glass level has dropped below 50%.

Safely dispose of used hydraulic fluid following all federal, state and local environmental regulations applicable to your area. The person disposing of the material is responsible for any hazard created.

**Back Pressure Gauge**

The suction gauge shown in Figure 11 - 4, should always remain in the green safe operating area, which is between 0 and 35 on the dial face. Once the back pressure increases and enters the yellow region of the gauge (35 to 43), it is time to replace the hydraulic filter. Do not operate the welder if the pressure is in the red area (greater than 43 psi). We recommend that you replace the hydraulic fluid whenever you install a new filter. For a replacement filter, contact Flodyne/Hydradyne Inc, Hanover Park, IL 60103 USA, (630) 563–5468. The filter element is Part No. 0075R010BN3HC. Also check the air vent filter by pushing in the cap and twisting counterclockwise (CCW). Replace the air filter if needed.

---

**Table 11-I**  
Equivalent Hydraulic Fluids For Normal and Elevated Temperatures

<table>
<thead>
<tr>
<th>Brand</th>
<th>Temperature 25° C Ambient</th>
<th>Ambient Temp. 30° C to 50° C</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGIP/Tutela</td>
<td>OSO 46</td>
<td>OSO 68</td>
</tr>
<tr>
<td>Atlantic</td>
<td>Ideal AW 46</td>
<td>Ideal AW 68</td>
</tr>
<tr>
<td>Castrol</td>
<td>Hyspin AWS 46</td>
<td>Hyspin AWS 68</td>
</tr>
<tr>
<td></td>
<td>Hyspin HDX 46</td>
<td>Hyspin HDX 68</td>
</tr>
<tr>
<td>ESSO</td>
<td>Nuto H 48</td>
<td>Nuto H 68</td>
</tr>
<tr>
<td>Ipiranga</td>
<td>Ipitur AW 46</td>
<td>Ipitur AW 68</td>
</tr>
<tr>
<td>Mobil Oil</td>
<td>Mobil DTE 25</td>
<td>Mobil DTE 26</td>
</tr>
<tr>
<td>Petrobras</td>
<td>Lubrax Industrial HR-46 EP</td>
<td>Lubrax Industrial HR-68 EP</td>
</tr>
<tr>
<td>Renolub (Fuchs)</td>
<td>Renolin B 15</td>
<td>Renolin B 20</td>
</tr>
<tr>
<td></td>
<td>Renolin MR 15</td>
<td>Renolin MR 20</td>
</tr>
<tr>
<td>Shell</td>
<td>Tellus 46</td>
<td>Tellus 68</td>
</tr>
<tr>
<td></td>
<td>Tellus T 46</td>
<td>Tellus T68</td>
</tr>
<tr>
<td>Texaco</td>
<td>Rando Oil HD446</td>
<td>Rando Oil HD68</td>
</tr>
</tbody>
</table>
Mechanical System

Grease Fittings

We recommend you grease the zerks once or twice a year with a good general-purpose industrial grease. In severe environments you might want to do it more often. The fittings are located on the top of each of the guide bearings. Figure 11-5 shows the location (looking from the front) of the eight fittings on a partially assembled chassis. Numbers 3, 4, 7 and 8 are accessible from the rear of the chassis. Figure 11-6 shows a detailed view of the front lower right grease fitting (No. 6). Keep the guide rails clean from any dirt or contaminants.

Table Position Encoder

The linear position encoder is shown in Figure 11-7. The device is rated for industrial use, but since it has a resolution of 0.01mm, it is quite sensitive to mechanical impact. Make sure the encoder shaft is kept clean and able to move freely. Do not lubricate the shaft. If the encoder readout is not accurate measuring the table position, check that the encoder is firmly attached to the table and properly calibrated by use of the User Options>Utilities>Calibrate Position Transducer screen (Figure 6-36, Page 79).

Tooling Care

Tooling left unused and open to the air may develop surface corrosion. Spray the surface of the tooling with a rust inhibitor like WD-40 or a corrosion solvent like LPS-2 to protect it. For long term storage, spray the surface of the tooling with LPS-3 corrosion inhibitor and wrap in plastic.
Contacting Dukane
Identify Equipment

When contacting Dukane about a service–related problem, be prepared to give the following information:

- Model number, line voltage and serial number.
- Alarm messages from the touch screen display.
- Problem description and steps taken to resolve it.

Many problems can be solved over the telephone, so it is best to call from a telephone located near the equipment.

Intelligent Assembly Solutions

Mailing Address:  Dukane Ultrasonics
2900 Dukane Drive
St. Charles, IL 60174  USA

Phone:  (630) 797–4900
E-Mail:  ussales@dukane.com
Fax:  
   Main -  (630) 797–4949
   Service & Parts - (630) 584–0796

Website
The website has information about our products, processes, solutions, and technical data. Downloads are available for many kinds of literature. This is our main web address:

www.dukane.com/us/

You can locate your local representative at:

www.dukane.com/us/sales/intsales.htm
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Tooling Specifications

Tooling Size & Weight

Table 13 - I gives the minimum and maximum weight and lateral dimension for the upper tooling for each model. The weight is critical since the drive heads are designed to drive a mass within a specific range. The length of the upper tooling is specified because you should completely cover the longitudinal spread of the spring frame to ensure acoustic coupling. However, you do not want more than about three inches of lateral (in direction of vibration) overhang on each end. More than three inches overhang will allow the unsupported ends to vibrate at their own resonant frequency. The minimum depth (front to back distance) of the upper tooling is dictated by the bolt holes spacing. There is no concern about overhang in the direction orthogonal to vibration.

The lower tooling can be as light as you want as long as it has the necessary strength to rigidly hold the lower part in place and covers the lower bolt hole pattern. Conversely, the lower tooling can be as heavy as you want, as long as the combined weight of the table and lower tool allow enough clamping force to be exerted on the part assembly during welding. Table 13 - I also gives the lift table size, weight and lift force for each model. The lift table dimensions are effectively the largest rectangular tooling that can normally be accommodated.

<table>
<thead>
<tr>
<th></th>
<th>VWB4300</th>
<th>VWB4500</th>
<th>VWB4700</th>
<th>VWB4900</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Tooling Weight</td>
<td>Max. 55 lb / 25 Kg</td>
<td>90 lb / 41 Kg</td>
<td>150 lb / 68 Kg</td>
<td>200 lb / 91 Kg</td>
</tr>
<tr>
<td></td>
<td>Min. 20 lb / 9 Kg</td>
<td>35 lb / 16 Kg</td>
<td>90 lb / 41 Kg</td>
<td>110 lb / 50 Kg</td>
</tr>
<tr>
<td>Upper Tooling Length</td>
<td>Max. 20&quot; / 508mm</td>
<td>36&quot; / 914mm</td>
<td>50&quot; / 1270mm</td>
<td>70&quot; / 1778mm</td>
</tr>
<tr>
<td></td>
<td>Min. 16&quot; / 406mm</td>
<td>26.5&quot; / 673mm</td>
<td>30&quot; / 762mm</td>
<td>50&quot; / 1270mm</td>
</tr>
<tr>
<td>Upper Tooling Width</td>
<td>Max. 14&quot; / 355mm</td>
<td>18&quot; / 457mm</td>
<td>24&quot; / 610mm</td>
<td>24&quot; / 610mm</td>
</tr>
<tr>
<td></td>
<td>Min. 13&quot; / 330mm</td>
<td>13&quot; / 330mm</td>
<td>15&quot; / 381mm</td>
<td>15&quot; / 381mm</td>
</tr>
<tr>
<td>Lower Tooling Weight</td>
<td>Max. 1000 lb / 453 Kg</td>
<td>1550 lb / 680 Kg</td>
<td>2000 lb / 9907 Kg</td>
<td>2000 lb / 9907 Kg</td>
</tr>
<tr>
<td></td>
<td>Min. 10 lb / 5 Kg</td>
<td>10 lb / 5 Kg</td>
<td>15 lb / 7 Kg</td>
<td>15 lb / 7 Kg</td>
</tr>
<tr>
<td>Lower Tooling Length</td>
<td>Max. 24&quot; / 610mm</td>
<td>38&quot; / 965mm</td>
<td>52&quot; / 1320 mm</td>
<td>72&quot; / 1830mm</td>
</tr>
<tr>
<td></td>
<td>Min. 16&quot; / 406mm</td>
<td>26.5&quot; / 673mm</td>
<td>30&quot; / 762mm</td>
<td>50&quot; / 1270mm</td>
</tr>
<tr>
<td>Lift Table Dimensions</td>
<td>24&quot; L x 18&quot; W 610mm x 457mm</td>
<td>36&quot; L x 18&quot; W 965mm x 457mm</td>
<td>52&quot; L x 24&quot; W 1320mm x 610mm</td>
<td>72&quot; L x 24&quot; W 1830mm x 610mm</td>
</tr>
<tr>
<td>Table Weight</td>
<td>300 lb / 136 Kg</td>
<td>435 lb / 197 Kg</td>
<td>630 lb / 286 Kg</td>
<td>750 lb / 340 Kg</td>
</tr>
<tr>
<td>Max. Hydraulic Clamp Force</td>
<td>3140 lb / 1424 Kg</td>
<td>4710 lb / 2052 Kg</td>
<td>7360 lb / 3338 Kg</td>
<td>7360 lb / 3338 Kg</td>
</tr>
<tr>
<td>Max. Programmable Clamp Force</td>
<td>3000 lb / 1361 Kg</td>
<td>4500 lb / 2040 Kg</td>
<td>5000 lb / 2268 Kg</td>
<td>5500 lb / 2268 Kg</td>
</tr>
</tbody>
</table>

**Table 13- I** Upper and Lower Tooling Weight and Dimensions

**NOTE**
Minimum table shut height for all models is 6 inches. Maximum daylight frame for all models is 25 inches.
Approximate Shipping Weights

The vibration welder is designed to be lifted and moved with a heavy-duty forklift. The welder is tied down and shipped on a pallet similar to the one shown in Figure 3 - 1, Page 17. The forklift should have a rated capacity greater than the shipping weight of the welder listed in Table 13 - II. These weights are approximate and do not include tooling or hydraulic fluid.

<table>
<thead>
<tr>
<th>VWB Model</th>
<th>Pounds</th>
<th>Kilograms</th>
</tr>
</thead>
<tbody>
<tr>
<td>4300</td>
<td>4,500</td>
<td>2,046</td>
</tr>
<tr>
<td>4500</td>
<td>5,900</td>
<td>2,675</td>
</tr>
<tr>
<td>4700</td>
<td>6,950</td>
<td>3,150</td>
</tr>
<tr>
<td>4900</td>
<td>7,950</td>
<td>3,600</td>
</tr>
</tbody>
</table>

Table 13-II Approximate Shipping Weights

Dimensions

Dimensions are shown in Table 13 - III.

For more information, see Space Requirements Drawings in this Section beginning on Page 147.

<table>
<thead>
<tr>
<th>VWB Model</th>
<th>Height **</th>
<th>Width</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>4300</td>
<td>74.9 (1902)</td>
<td>48 (1219)</td>
<td>52 (1321)</td>
</tr>
<tr>
<td>4500</td>
<td>80.5 (2045)</td>
<td>81 (2057)</td>
<td>44.5 (1130)</td>
</tr>
<tr>
<td>4700</td>
<td>80.5 (2045)</td>
<td>101 (2565)</td>
<td>51 (1295)</td>
</tr>
<tr>
<td>4900</td>
<td>80.5 (2045)</td>
<td>121 (3073)</td>
<td>51 (1295)</td>
</tr>
</tbody>
</table>

** Add for adjustable leveling feet height - between 1 - 3 in (25 - 76 mm)

Table 13-III Welder Dimensions - in (mm)

NOTE

See Space Requirements Drawings starting on Page 147.
Operating Environment

Operate the vibration welder within these guidelines:

**Temperature:** 40°F to 95°F (+5°C to +35°C)

**Air Particulates:** Keep the equipment dry. Minimize exposure to moisture, dust, dirt, smoke and mold.

**Humidity:** 5% to 95% Non-condensing @ +5°C to +30°C

**Altitude:** Sea level to 15,000' (4,570 m)
Power Requirements

AC Power

See Table 13-IV. With the exception of Model 4900, the power cord uses a three-pole, four-blade, grounding type plug designed for 3-Phase 480 VAC at 30 Amps. The 480 VAC 3-Phase plug configuration is shown in Figure 13-1. It is designed to be plugged into a 480 VAC, 3-Phase, 30 Amp, NEMA type L16–30R receptacle as shown in Figure 13-2.

The power cord supplied is approximately 14 feet long. For Model 4300, the user passes the cord through one of the Power Port holes (See Figure 13-3). For Models 4500 and 4700 the cord exits from the top rear of the welder cabinet, so the 480 VAC outlet needs to be close to the machine. **Model 4900 is not supplied with a power cord.**

Consult your local electrical guidelines to learn if the machine can be operated with a power cord plugged into an outlet, or if it needs to be hardwired to a 480 Volt circuit. For safety and reliability, the machine should be permanently wired inside electrical conduit to a 480 Volt circuit. A minimum of 10-Gauge wire is recommended to safely handle the 30-Amp welder current.

**NOTE: Model 4900 requires a 480VAC, 3 Phase, 40 Amp source of electrical power.**

Do not alter the plug or receptacle in any way. Do not use an extension cord. If there is any question about the grounding or phasing of your AC power, have it checked by a qualified electrician.

<table>
<thead>
<tr>
<th>Model</th>
<th>Volts</th>
<th>Amps</th>
<th>Power Cord with Plug Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>4300</td>
<td>480</td>
<td>30</td>
<td>Yes, but not connected. See Fig 13-3 for Power Port Holes.</td>
</tr>
<tr>
<td>4500</td>
<td>480</td>
<td>30</td>
<td>Yes, connected.</td>
</tr>
<tr>
<td>4700</td>
<td>480</td>
<td>30</td>
<td>Yes, connected.</td>
</tr>
<tr>
<td>4900</td>
<td>480</td>
<td>40</td>
<td>No power cord supplied.</td>
</tr>
</tbody>
</table>

Table 13-IV  AC Power Requirements

Compressed Air

The welder requires a supply of clean, dry, compressed air at 75 to 90 psi (0.52 to 0.62 MPascal or 5.1 to 6.1 Bar).
Figure 13-3  Model 4300 Floor Space Requirements

AIR DROP

ELECTRICAL DISCONNECT

DOOR SWING

6.00 [152] Side Space (both sides)

6.63 [168] Inches

Recommended Minimum Clear Area For Tool Change (31” W x 36” D)

60.00 [1524] Total Minimum Recommended Clear Area (60” W x 114” D)

Power Port Holes (1.06” Dia.) One in top; one in side. For electrical cord.

Inches [mm]

Convert inches to millimeters by multiplying by 25.4

Access Hatch

Dukane Manual Part No. 403-582-02

Dukane
Figure 13–4 Model 4500 Floor Space Requirements
Figure 13-5  Model 4700 Floor Space Requirements (29-Inch Rear Service Doors)
Figure 13-6  Model 4900 Floor Space Requirements
Regulatory Agency Compliance

FCC
The equipment complies with the following Federal Communications Commission regulations.


CE Marking
This mark on your equipment certifies that it meets the requirements of the EU (European Union) concerning interference causing equipment regulations. CE stands for Conformité Européenne (European Conformity). The equipment complies with the following CE requirements.

- The EMC Directive 2004/108/EC for Heavy Industrial —
  - EN 61000-6-4: 2001
  - EN 55011: 2003
  - EN 61000-6-2: 2001
  - EN61000–4–2
  - EN61000–4–3
  - EN61000–4–4
  - EN61000–4–5
  - EN61000–4–6
  - EN61000–4–8
  - EN61000–4–11

- The Low Voltage Directive 2006/95/EC.

- The Machinery Directive 2006/42/EC.
  - EN 60204: 2006

NOTE
DO NOT make any modifications to the PLC, its program, or to the vibration welder as delivered by Dukane. Unauthorized changes made to the system may result in violating one or more regulations under which this equipment is manufactured. In addition, any warranties applying to the system expressed or implied may be void.
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Appendix A - Joint Designs

Joint design is critical to the success of friction welding processes. The designs shown below are examples. Proper joint design involves many factors including application requirements and material. Call Dukane’s Application Lab for additional information. We are plastic welding scientists and engineers and experts in plastic assembly. We are your problem solvers and technical advisors.

Vibration Butt Joint

The figure below shows a basic weld bead for vibration welding.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>General Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Weld Rib Width 1.2W</td>
</tr>
<tr>
<td>B</td>
<td>Weld Rib Height 0.050&quot; - 0.080&quot; (1.25mm - 2.0mm)</td>
</tr>
<tr>
<td>C</td>
<td>Cosmetic Gap Height 0.020&quot; - 0.040&quot; (0.5mm - 1.0mm)</td>
</tr>
<tr>
<td>M</td>
<td>Melt Down 0.040&quot; - 0.060&quot; (1.0mm - 1.5mm)</td>
</tr>
<tr>
<td>W</td>
<td>Wall Thickness Minimum 0.120&quot; (3mm)</td>
</tr>
</tbody>
</table>

Figure A-1  Vibration Butt Joint
Vibration Butt Joint with External Flash Trap

The figure below illustrates a joint that will control flash in one direction. It will also aid in rough location of one part to another part.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>General Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Weld Rib Width</td>
</tr>
<tr>
<td>B</td>
<td>Weld Rib Height</td>
</tr>
<tr>
<td>C</td>
<td>Cosmetic Gap Height</td>
</tr>
<tr>
<td>D</td>
<td>Vibration Clearance</td>
</tr>
<tr>
<td>M</td>
<td>Melt Down</td>
</tr>
<tr>
<td>W</td>
<td>Wall Thickness</td>
</tr>
</tbody>
</table>

Figure A-2  Vibration Butt Joint with External Flash Trap
Vibration Rib Joint

This figure illustrates several ways to stiffen internal ribs in a part. The use of gussets and cross ribs can stabilize weld ribs during the vibration process. Long, unsupported weld ribs in a part will flex, and they cannot be welded.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>General Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Clearance</td>
</tr>
<tr>
<td>D</td>
<td>Distance Between Ribs</td>
</tr>
<tr>
<td>H</td>
<td>Rib Height</td>
</tr>
<tr>
<td>M</td>
<td>Melt Down</td>
</tr>
<tr>
<td>R</td>
<td>Rib Width</td>
</tr>
<tr>
<td>S</td>
<td>Support Rib Height</td>
</tr>
<tr>
<td>W</td>
<td>Wall Thickness</td>
</tr>
</tbody>
</table>

- **C** Clearance: Minimum 0.030” (0.75mm)
- **D** Distance Between Ribs: 0.550” - 0.865” (14mm - 22mm)
- **H** Rib Height: 0.235” - 0.790” (6mm - 20mm)
- **M** Melt Down: 0.040” - 0.060” (1mm - 1.5mm)
- **R** Rib Width: Minimum 0.040” (1mm)
- **S** Support Rib Height: 0.080” - 0.120” (2mm - 3mm)
- **W** Wall Thickness: Minimum 0.060” (1.5mm)

**Figure A-3** Vibration Rib Joint
Vibration Butt Joint with Flash Traps

This figure illustrates joint design controlling flash in both directions. Additionally, there is use of a return flange to help stabilize tall, exterior walls on parts.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>General Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Butt Joint Width ~ 0.160&quot; (4mm)</td>
</tr>
<tr>
<td>B</td>
<td>Butt Joint Height ~ 0.060&quot; (1.5mm)</td>
</tr>
<tr>
<td>C</td>
<td>Cosmetic Gap Height ~ 0.040&quot; (1.0mm)</td>
</tr>
<tr>
<td>D</td>
<td>Groove Depth 2B</td>
</tr>
<tr>
<td>E</td>
<td>Side Wall Taper 15°</td>
</tr>
<tr>
<td>H</td>
<td>Side Wall Height 0.080&quot; (2mm)</td>
</tr>
<tr>
<td>M</td>
<td>Melt Down 0.060&quot; (1.5mm)</td>
</tr>
<tr>
<td>S</td>
<td>Side Wall Width 0.060&quot; (1.5mm)</td>
</tr>
<tr>
<td>T</td>
<td>Tongue Width A + 0.080&quot; (2mm)</td>
</tr>
<tr>
<td>W</td>
<td>Wall Thickness 0.120&quot; (3mm)</td>
</tr>
</tbody>
</table>

Figure A-4  Vibration Butt Joint with Flash Traps
Welding Problems and Solutions

Some of the faults associated with vibration welding are caused by joint design and some are due to improper weld parameter settings. Table A-I lists some of the more common problems, the causes and solutions.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Symptom</th>
<th>Possible Cause</th>
<th>Recommended Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overwelding</td>
<td>Excessive weld flash. Final dimensions of part are too small.</td>
<td>Weld time too long.</td>
<td>Reduce weld time.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weld distance too large.</td>
<td>Reduce weld distance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Incorrect flash trap design.</td>
<td>Evaluate and correct flash trap design.</td>
</tr>
<tr>
<td>Underwelding</td>
<td>Low weld strength.</td>
<td>Weld Time too short.</td>
<td>Increase weld time.</td>
</tr>
<tr>
<td></td>
<td>Final dimensions of part are too large.</td>
<td>Weld distance too small.</td>
<td>Increase weld distance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Material difficult to weld due to low friction coefficient.</td>
<td>Degrease joint interface to remove mold release agent. Consider changing material (avoid PFTE).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Weld ribs flex during weld.</td>
<td>Change design to eliminate rib flexing or change direction of vibration.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parts moving in tooling (visible dust or scratches on parts).</td>
<td>Adjust nest to hold part. Add return flanges to part. Add vacuum to fixture.</td>
</tr>
<tr>
<td>Nonuniform or inconsistent weld joints</td>
<td>Excessive weld flash.</td>
<td>Warped parts.</td>
<td>Check part dimensions.</td>
</tr>
<tr>
<td></td>
<td>Low weld strength.</td>
<td>Uneven weld interface.</td>
<td>Check molding process conditions.</td>
</tr>
<tr>
<td></td>
<td>Failure when leak tested.</td>
<td>Fixture and part are not parallel.</td>
<td>Shim fixture where necessary. Check that tooling is true to table.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insufficient fixture support.</td>
<td>Check for parts shifting during welding. Provide means for alignment in mating parts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vibration stalling.</td>
<td>Evaluate joint constraint due to tooling design or mold processing.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Walls are flexing during welding.</td>
<td>Redesign parts with reinforcing ribs and/or tongue and groove joints.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Excessive filler or uneven distribution.</td>
<td>Reduce amount of filler. Improve processing conditions to ensure even distribution of filler.</td>
</tr>
</tbody>
</table>

Table A-I Common Welding Problems and Solutions
## Appendix B

### List of Figures

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<th>Description</th>
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<td>20</td>
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<td>Disengaging the Disconnect Switch</td>
<td>20</td>
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<td>Right Operate Switch and Vacuum Button</td>
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<td>35</td>
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<td>36</td>
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<td>37</td>
</tr>
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<td>37</td>
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<td>37</td>
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<td>41</td>
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Continued
## Appendix B  Continued

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<th>No.</th>
<th>Description</th>
<th>Page</th>
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Notes on the Backup Battery

The battery is principally used to back-up the internal RAM area (program, retentive device, RTC and others) in the PLC main unit.

Battery Life and Date of Manufacture

• Battery life: Approx. 5 years (ambient temperature: 25°C) [Guarantee period: 1 year after delivery or 18 months after production]
• Replacement period: Within 4 or 5 years (Due to normal discharge with all batteries, please have a replacement before the above-stated replacement period.)
• Example of date-of-manufacture indicator: See Figure D-2.

Caution on Use

Installation

• Power off the PLC (all phase) before attaching/detaching the battery.
• Securely attach the connector to the battery connector on the PLC main unit.
• Firmly attach the battery cover when powering on the PLC or during operation.

Transport and Storage

• During transportation or other such occurrence, avoid any impact to the battery as the PLC may be seriously damaged by the liquid leakage etc. from the battery.

Disposal

• Please contact a company certified in the disposal of electronic waste for environmentally safe recycling and disposal of this product.
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ISO CERTIFICATION

Dukane chose to become ISO 9001:2008 certified in order to demonstrate to our customers our continuing commitment to being a quality vendor. By passing its audit, Dukane can assure you that we have in place a well-defined and systematic approach to quality design, manufacturing, delivery and service. This certificate reinforces Dukane's status as a quality vendor of technology and products.

To achieve ISO 9001:2008 certification, you must prove to one of the quality system registrar groups that you meet three requirements:
1. Leadership
2. Involvement

The ISO 9001:2008 standard establishes a minimum requirement for these requirements and starts transitioning the company from a traditional inspection-oriented quality system to one based on partnership for continuous improvement. This concept is key in that Dukane no longer focuses on inspection, but on individual processes.

Dukane’s quality management system is based on the following three objectives:
1. Customer oriented quality. The aim is to improve customer satisfaction.
2. Quality is determined by people. The aim is to improve the internal organization and cooperation between staff members.
3. Quality is a continuous improvement. The aim is to continuously improve the internal organization and the competitive position.

Dukane products are manufactured in ISO registered facilities.
Please refer to our website at:

www.dukane.com/us/sales/intsales.htm

to locate your local representative.