



# Advanced Color Logic® Owner's Manual

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Manual:	091-0610
Serial:	13110001
Voltage Rating:	120/208-240VAC
Revision:	Oct 2013 Rev C
Model Number:	254-203 254-302



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Warranty

# *Declaration of Conformity for European Community (CE) Products*

**Note**  This information is provided for units with CE certification (see rating label on unit).

*Manufacturer's Name:* **MK Products, Inc.**  
16882 Armstrong Ave.  
Irvine, CA 92606

*Declares that the product:* **Advanced Color Logic<sup>®</sup>**  
*conforms to the following Directives and Standards:*

## Directives

Low Voltage Directive: 2006/95/EC

Electromagnetic Compatibility (EMC) Directive: 2004/108/EC

## Standards

Electromagnetic Compatibility, (EMC): EN 60974-10: 2007

Torches And Guns For Arc Welding, EN 60974-7: 2005

# SAFETY CONSIDERATIONS

## ELECTRIC ARC WELDING EQUIPMENT

### CAUTION : READ BEFORE ATTEMPTING INSTALLATION, OPERATION OR MAINTENANCE OF THIS EQUIPMENT

#### 1-1 INTRODUCTION

This equipment is intended for ultimate application by commercial/industrial users and for operation by persons trained and experienced in the use and maintenance of welding equipment. Operation should not be undertaken without adequate training in the use of such equipment. Training is available from many public and private schools or similar facilities.

Safe practices in the installation, operation and maintenance of this equipment requires proper training in the art, a careful study of the information provided with the equipment, and the use of common sense. Rules for safe use are generally provided by suppliers of welding power sources, compressed gas suppliers, and electrode suppliers. Careful compliance with these rules will promote safe use of this equipment.

The following Safety Rules cover some of the more generally found situations. READ THEM CAREFULLY. In case of any doubt, obtain qualified help before proceeding.

#### 1-2 GENERAL PRECAUTIONS

##### A. Burn Prevention

**ELECTRIC ARC WELDING PRODUCES HIGH INTENSITY HEAT AND ULTRAVIOLET RADIANT ENERGY WHICH MAY CAUSE SERIOUS AND PERMANENT EYE DAMAGE AND WHICH MAY DAMAGE ANY EXPOSED SKIN AREAS.**

Wear helmet with safety goggles or glasses with side shields underneath, appropriate filter lenses or plates (protected by clear cover glass). This is a must for welding or cutting (and chipping) to protect the eyes from radiant energy and flying metal. Replace cover glass when broken, pitted, or spattered.

Medical first aid and eye treatment. First aid facilities and a qualified first aid person should be available for each shift unless medical facilities are close by for immediate treatment of flash burns of the eyes and skin burns.

Wear protective clothing - leather (or asbestos) gauntlet gloves, hat, and high safety-toe shoes. Button shirt collar and pocket flaps, and wear cuffless trousers to avoid entry of sparks and slag.

Avoid oily or greasy clothing. A spark may ignite them.

Flammable hair preparations should not be used by persons intending to weld or cut.

Hot metal such as electrode stubs and work pieces should never be handled without gloves.

Ear plugs should be worn when working on overhead or in a confined space. A hard hat should be worn when others work overhead.

##### B. Toxic Fume Prevention

**WARNING:** The use of this product may result in exposure to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Adequate ventilation. Severe discomfort, illness or death can result from fumes, vapors, heat, or oxygen enrichment or depletion that welding (or cutting) may produce. Prevent them with adequate ventilation. NEVER ventilate with oxygen.

Lead-, cadmium-, zinc-, mercury-, beryllium-bearing and similar materials, when welded or cut, may produce harmful concentrations of toxic fumes. Adequate local exhaust ventilation must be used, or each person in the area, as well as the operator, must wear an air-supplied respirator. For beryllium, both must be used.

Metals coated with or containing materials that emit toxic fumes should not be heated unless coating is removed from the work surface, the area is well ventilated, or the operator wears an air-supplied respirator.

Work in a confined space only while it is being ventilated and, if necessary, while wearing an air-supplied respirator.

Gas leaks in a confined space should be avoided. Leaked gas in large quantities can change oxygen concentration dangerously. Do not bring gas cylinders into a confined space.

Leaving confined space, shut OFF gas supply at source to prevent possible accumulation of gases in the space if downstream valves have been accidentally opened or left open. Check to be sure that the space is safe before reentering it.

Vapors from chlorinated solvents can be decomposed by the heat of the arc (or flame) to form PHOSGENE, a highly toxic gas, and other lung and eye irritating products. The ultraviolet (radiant) energy of the arc can also decompose trichloroethylene and perchloroethylene vapors to form phosgene. DO NOT WELD or cut where solvent vapors can be drawn into the welding or cutting atmosphere or where the radiant energy can penetrate to atmospheres containing even minute amounts of trichloroethylene or perchloroethylene.

##### C. Fire and Explosion Prevention

Causes of fire and explosion are: combustibles reached by the arc, flame, flying sparks, hot slag, or heated material, misuse of compressed gases and cylinders, and short circuits.

BE AWARE THAT flying sparks or falling slag can pass through cracks, along pipes, through windows or doors, and through wall or floor openings, out of sight of the goggled operator. Sparks can fly many feet.

To prevent fires and explosion:

Keep equipment clean and operable, free of oil, grease, and (in electrical parts) of metallic particles that can cause short circuits.

If combustibles are in area, do NOT weld or cut. Move the work if practicable, to an area free of combustibles. Avoid paint spray rooms, dip tanks, storage areas, ventilators. If the work cannot be moved, move combustibles at least 35 feet away, out of reach of sparks and heat; or protect against ignition with suitable and snug-fitting, fire-resistant covers or shields.

Walls touching combustibles on opposite sides should not be welded on (or cut). Walls, ceilings, and floor near work should be protected by heat-resistant covers or shields.

Fire watcher must be standing by with suitable fire extinguishing equipment during and for some time after welding or cutting if:

1. Appreciable combustibles (including building construction) are within 35 feet.
2. Appreciable combustibles are further than 35 feet, but can be ignited by sparks.
3. Openings (concealed or visible) in floors or walls within 35 feet may expose combustibles to sparks.
4. Combustibles adjacent to walls, ceilings, roofs, or metal partitions can be ignited by radiant or conducted heat.

Hot work permit should be obtained before operation to ensure supervisor's approval that adequate precautions have been taken.

After work is done, check that area is free of sparks, glowing embers, and flames.

An empty container that held combustibles, or that can produce flammable or toxic vapors when heated, must never be welded on or cut, unless container has first been cleaned in accordance with industry standards.

This includes: a thorough steam or caustic cleaning (or a solvent of water washing, depending on the combustible's solubility), followed by purging and inerting with nitrogen or carbon dioxide, and using protective equipment.

Water-filling just below working level may substitute for inerting.

A container with unknown contents should be cleaned (see paragraph above). Do NOT depend on sense of smell or sight to determine if it is safe to weld or cut.

Hollow castings or containers must be vented before welding or cutting. They can explode.

Explosive atmospheres. NEVER weld or cut where the air may contain flammable dust, gas, or liquid vapors (such as gasoline).

#### **D. Compressed Gas Equipment**

The safe handling of compressed gas equipment is detailed in numerous industry publications. The following general rules cover many of the most common situations.

##### **1. Pressure Regulators**

Regulator relief valve is designed to protect only the regulator from overpressure; it is not intended to protect any downstream equipment. Provide such protection with one or more relief devices.

Never connect a regulator to a cylinder containing gas other than that for which the regulator was designed.

Remove faulty regulator from service immediately for repair (first close cylinder valve). The following symptoms indicate a faulty regulator:

Leaks - if gas leaks externally.

Excessive Creep - if delivery pressure continues to rise with downstream valve closed.

Faulty Gauge - if gauge pointer does not move off stop pin when pressurized, nor returns to stop pin after pressure release.

Repair. Do NOT attempt repair. Send faulty regulators for repair to manufacturer's designated repair center, where special techniques and tools are used by trained personnel.

##### **2. Cylinders**

Cylinders must be handled carefully to prevent leaks and damage to their walls, valves, or safety devices:

Avoid electrical circuit contact with cylinders including third rails, electrical wires, or welding circuits. They can produce short circuit arcs that may lead to a serious accident. (See 1-3C)

ICC or DOT marking must be on each cylinder. It is an assurance of safety when the cylinder is properly handled.

Identifying gas content. Use only cylinders with name of gas marked on them; do not rely on color to identify

gas content. Notify supplier if unmarked. NEVER DEFACE or alter name, number, or other markings on a cylinder. It is illegal and hazardous.

Empties: Keep valves closed, replace caps securely; mark MT; keep them separate from FULLS, and return promptly.

Prohibited use. Never use a cylinder or its contents for other than its intended use, NEVER as a support or roller.

Locate or secure cylinders so they cannot be knocked over.

Passageways and work areas. Keep cylinders clear of areas where they may be stuck.

Transporting cylinders. With a crane, use a secure support such as a platform or cradle. Do NOT lift cylinders off the ground by their valves or caps, or by chains, slings, or magnets.

Do NOT expose cylinders to excessive heat, sparks, slag, and flame, etc. that may cause rupture. Do not allow contents to exceed 55° C (130° F.) Cool with water spray where such exposure exists.

Protect cylinders, particularly valves from bumps, falls, falling objects, and weather. Replace caps securely when moving cylinders.

Stuck valve. Do NOT use a hammer or wrench to open a cylinder valve that cannot be opened by hand. Notify your supplier.

Mixing gases. NEVER try to mix any gases in a cylinder.

NEVER refill any cylinder.

Cylinder fittings should never be modified or exchanged.

##### **3. Hose**

Prohibited use. Never use hose other than that designed for the specified gas. A general hose identification rule is: red for fuel gas, green for oxygen, and black for inert gases.

Use ferrules or clamps designed for the hose (not ordinary wire or other substitute) as a binding to connect hoses to fittings.

No copper tubing splices. Use only standard brass fittings to splice hose.

Avoid long runs to prevent kinks and abuse. Suspend hose off ground to keep it from being run over, stepped on, or otherwise damaged.

Coil excess hose to prevent kinks and tangles.

Protect hose from damage by sharp edges, and by sparks, slag, and open flame.

Examine hose regularly for leaks, wear, and loose connections. Immerse pressured hose in water; bubbles indicate leaks

Repair leaky or worn hose by cutting area out and splicing. Do NOT use tape.

##### **4. Proper Connections**

Clean cylinder valve outlet of impurities that may clog orifices and damage seats before connecting regulator. Except for hydrogen, crack valve momentarily, pointing outlet away from people and sources of ignition.

Wipe with a clean, lintless cloth.

Match regulator to cylinder. Before connecting, check that the regulator label and cylinder marking agree, and that the regulator inlet and cylinder outlet match. NEVER Connect a regulator designed for a particular gas or gases to a cylinder containing any other gas.

Tighten connections. When assembling threaded connections, clean and smooth seats where necessary. Tighten. If connection leaks, disassemble, clean, and retighten, using properly fitting wrench.

Adapters. Use a CGA adapter (available from your supplier) between cylinder and regulator, if one is required. Use two wrenches to tighten adapter marked RIGHT and LEFT HAND threads.

Regulator outlet (or hose) connections may be identified by right hand threads for oxygen and left hand threads (with grooved hex on nut or shank) for fuel gas.

##### **5. Pressurizing Steps:**

Drain regulator of residual gas through suitable vent before opening cylinder (or manifold valve) by turning adjusting screw in (clockwise). Draining prevents excessive compression heat at high pressure seat by allowing seat to open on pressurization. Leave adjusting screw engaged slightly on single-stage regulators.

Stand to side of regulator while opening cylinder valve.

Open cylinder valve slowly so that regulator pressure increases slowly. When gauge is pressurized (gauge reaches regulator maximum) leave cylinder valve in following position: for oxygen and inert gases, open fully to seal stem against possible leak; for fuel gas, open to less than one turn to permit quick emergency shut-off.

Use pressure charts (available from your supplier) for safe and efficient recommended pressure settings on regulators.

Check for leaks on first pressurization and regularly thereafter. Brush with soap solution. Bubbles indicate leaks. Clean off soapy water after test; dried soap is combustible.

##### **E. User Responsibilities**

Follow all Safety Rules.

Remove leaky or defective equipment from service immediately for repair. Read and follow user manual instructions.

##### **F. Leaving Equipment Unattended**

Close gas supply at source and drain gas.

##### **G. Rope Staging-Support**

Rope staging-support should not be used for welding or cutting operation; rope may burn.

## **1-3 ARC WELDING**

Comply with precautions in 1-1, 1-2,

and this section. Arc Welding, properly done, is a safe process, but a careless operator invites trouble. The equipment carries high currents at significant voltages. The arc is very bright and hot. Sparks fly, fumes rise, ultraviolet and infrared energy radiates, weldments are hot, and compressed gases may be used. The wise operator avoids unnecessary risks and protects himself and others from accidents.

#### **A. Burn Protection**

Comply with precautions in 1-2.

The welding arc is intense and visibly bright. Its radiation can damage eyes, penetrate lightweight clothing, reflect from light-colored surfaces, and burn the skin and eyes. Skin burns resemble acute sunburn; those from gas-shielded arcs are more severe and painful. **DON'T GET BURNED; COMPLY WITH PRECAUTIONS.**

#### **1. Protective Clothing**

Wear long-sleeve clothing in addition to gloves, hat, and shoes. As necessary, use additional protective clothing such as leather jacket or sleeves, flameproof apron, and fire-resistant leggings. Avoid outer garments of untreated cotton.

Bare skin protection. Wear dark, substantial clothing. Button collar to protect chest and neck, and button pockets to prevent entry of sparks.

#### **2. Eye and Head Protection**

Protect eyes from exposure to arc. Eyes may be damaged by radiant energy when exposed to the electric arc, even when not looking in the direction of the arc. Never look at an electric arc without protection.

Welding helmet or shield containing a filter plate shade no. 12 or denser must be used when welding. Place over face before striking arc.

Protect filter plate with a clear cover plate.

Cracked or broken helmet or shield should NOT be worn; radiation can be passed through to cause burns.

Cracked, broken, or loose filter plates must be replaced IMMEDIATELY. Replace clear cover plate when broken, pitted, or spattered.

Flash goggles with side shields MUST be worn under the helmet to give some protection to the eyes should the helmet not be lowered over the face before an arc is struck. Looking at an arc momentarily with unprotected eyes (particularly a high intensity gas-shielded arc) can cause a retinal burn that may leave a permanent dark area in the field of vision.

#### **3. Protection of Nearby Personnel**

Enclose the welding area. For production welding, a separate room or enclosed bay is best. In open areas, surround the operation with low-reflective, noncombustible screens or panels. Allow for free air circulation, particularly at

floor level.

Viewing the weld. Provide face shields for all persons who will be looking directly at the weld.

Others working in area. See that all persons are wearing flash goggles.

Before starting to weld, make sure that screen flaps or bay doors are closed.

#### **B. Toxic Fume Prevention**

Comply with precautions in 1-2B.

Generator engine exhaust must be vented to the outside air. Carbon monoxide can kill.

#### **C. Fire and Explosion Prevention**

Comply with precautions in 1-2C.

Equipment's rated capacity. Do not overload arc welding equipment. It may overheat cables and cause a fire.

Loose cable connections may overheat or flash and cause a fire.

Never strike an arc on a cylinder or other pressure vessel. It creates a brittle area that can cause a violent rupture or lead to such a rupture later under rough handling.

#### **D. Compressed Gas Equipment**

Comply with precautions in 1-2D.

#### **E. Shock Prevention**

Exposed electrically hot conductors or other bare metal in the welding circuit, or in ungrounded, electrically-HOT

equipment can fatally shock a person whose body becomes a conductor. **DO NOT STAND, SIT, LIE, LEAN ON, OR TOUCH** a wet surface when welding without suitable protection.

To protect against shock:

Keep body and clothing dry. Never work in damp area without adequate insulation against electrical shock. Stay on a dry duckboard, or rubber mat when dampness or sweat cannot be avoided. Sweat, sea water, or moisture between body and an electrically HOT part - or grounded metal - reduces the body surface electrical resistance, enabling dangerous and possibly lethal currents to flow through the body.

#### **1. Grounding the Equipment**

When installing, connect the frames of each unit such as welding power source, control, work table, and water circulator to the building ground. Conductors must be adequate to carry ground currents safely. Equipment made electrically HOT by stray currents may shock, possibly fatally. **DO NOT GROUND** to electrical conduit, or to a pipe carrying ANY gas or a flammable liquid such as oil or fuel.

Three-phase connection. Check phase requirement of equipment before installing. If only three-phase power is available, connect single-phase equipment to only two wires of the three-phase line. **DO NOT** connect the equipment ground lead to the third (live) wire, or the equipment will become electrically HOT - a dangerous condition that can shock, possibly fatally.

Before welding, check ground for continuity.

Be sure conductors are touching bare metal of equipment frames at connections.

If a line cord with a ground lead is provided with the equipment for connection to a switch box, connect the ground lead to the grounded switch box. If a three-prong plug is added for connection to a grounded mating receptacle, the ground lead must be connected to the ground prong only. If the line cord comes with a three-prong plug, connect to a grounded mating receptacle. Never remove the ground prong from a plug, or use a plug with a broken ground prong.

#### **2. Connectors**

Fully insulated lock-type connectors should be used to join welding cable lengths.

#### **3. Cables**

Frequently inspect cables for wear, cracks, and damage. **IMMEDIATELY REPLACE** those with excessively worn or damaged insulation to avoid possibly lethal shock from bared cable. Cables with damaged areas may be taped to give resistance equivalent to original cable.

Keep cable dry, free of oil and grease, and protected from hot metal and sparks.

#### **4. Terminals and Other Exposed Parts**

Terminals and other exposed parts of electrical units should have insulating covers secured before operation.

#### **5. Electrode Wire**

Electrode wire becomes electrically HOT when the power switch of gas metal-arc welding equipment is ON and welding gun trigger is pressed. Keep hands and body clear of wire and other HOT parts.

#### **6. Safety Devices**

Safety devices such as interlocks and circuit breakers should not be disconnected or shunted out.

Before installation, inspection, or service of equipment, shut OFF all power, and remove line fuses (or lock or red-tag switches) to prevent accidental turning ON of power. Disconnect all cables from welding power source, and pull all 115 volts line-cord plugs.

Do not open power circuit or change polarity while welding. If, in an emergency, it must be disconnected, guard against shock burns or flash from switch arcing.

Leaving equipment unattended. Always shut OFF, and disconnect all power to equipment.

Power disconnect switch must be available near the welding power source.

# Thank You

For selecting a quality product. We want you to take pride in operating this product...as much pride as we have in bringing the product to you!

## **Please Examine Carton and Equipment For Damage Immediately**

When this equipment is shipped, title passes to the purchaser upon receipt by the carrier. Consequently, claims for material damaged in shipment must be made by the purchaser against the transportation company at the time the shipment is received.

Please record your equipment identification information below for future reference. This information can be found on your machine nameplate.

Model Name & Number \_\_\_\_\_

Code & Serial Number \_\_\_\_\_

Date of Purchase \_\_\_\_\_

Whenever you request replacements parts for, or information on this equipment always supply the information you have recorded above.

Read this Owner's Manual completely before attempting to use this equipment. Save this manual and keep it handy for quick reference. Pay particular attention to the safety instructions we have provided for your protection.

## Section A

## Installation

### 1. Technical Specifications

#### Electrical Characteristics:

Line Power:	120 VAC ( $\pm 10\%$ ), 50/60 Hz 208 - 240 VAC ( $\pm 10\%$ ), single phase, 50/60 Hz. 208 - 240 VAC ( $\pm 10\%$ ), three phase, 50/60 Hz.
Output Current:	1 to 200 amps ( $\pm 1.0\%$ ), constant or pulsed.
Pulse Rate:	0.01 to 9.99 seconds per pulse.
Arc Voltage:	80VDC open circuit, up to 20VDC during welding
Loop Response:	3KHz
Current Regulator Frequency:	18KHz
Motor Control:	24V, 2 amp maximum, DC tachometer feedback or back EMF (optional).

#### Mechanical Characteristics:

Width:	16.75 inches
Height:	16.25 inches
Depth:	27.5 inches
Weight:	110 lbs. (ACL only)
Shipping Weight:	350 lbs. (includes ACL, monitor, printer, keyboard, power cable and Customer Start-Up Kit; palletized)

#### Computer Control System:

Microcomputer Architecture:	Embedded operating system.
Computer Memory:	AMD Athlon 2200+ or faster. 128MB or more DRAM memory. 1MB static RAM for weld procedure storage. Floppy drive for procedure back-up, transfer, real time logging & program upgrade.
Program storage:	1000 procedures (600 bytes average size) stored in 1MB SRAM.

### 2. Machine Grounding

The ACL is grounded through the input power cord. Consult local and national electrical codes for proper grounding methods.

### 3. Machine Location

The ACL should be placed in a location where it can be protected from damage. Lead lengths and accessibility must also be considered when installing the ACL. The rear of the ACL must be a minimum of three inches so that clean cooling air can circulate through the machine. Dirt, dust, or any foreign material that can be drawn into the welder should be kept at a minimum.

Keep the ACL in a dry, sheltered area, since a wet environment is a possible safety hazard and may cause improper operation.

### 4. Input Power Connections

The Input Power Cord has a standard 120 VAC power plug on one end and a 16-pin Amphenol connector on the other end.

The Input Power Cord is wired for the voltage and phase which was specified when the ACL was ordered.

## Section B

If a different value input power voltage is required after the initial setup, a different power cord will have to be ordered (Reference Section C - Accessories.) The wiring of the power cord determines the input power and phase.

## Operation

### 1. Power Source Startup

This section describes the different sequence of screens at startup for the ACL. When the power is turned on, a short series of automatic self-tests take place. These tests are necessary to ensure that the ACL, which includes the computer, keyboard, HHC (Hand Held Control), interface connections, and the program are all compatible and in proper working order. During this start-up sequence, the system checks for any failures. If there are any failures of any component or programs, they will be reported on the monitor and the HHC. If all the tests pass, without a failure found or reported, the system will continue on to the next step of the program.

The ACL system start-up sequence goes through the following steps:

- 1.1 Power Up - when power is applied to the system.
- 1.2 Logo and Program Load Screen - displays logo for MK Products, Inc. while loading software.
- 1.3 Self-Check - series of self-checks verifies readiness.

#### 1.1 Power-Up

The start-up and shutdown procedures are the same for the Teach and the Production Modes. Before attempting to power up the ACL, the operator should become thoroughly familiar with this section of this manual. Follow this procedure to assure power-up and self-diagnostic sequences occur:

Prior to connecting to AC input power; plug the factory supplied power cord into the rear panel receptacle of the ACL (making sure the keying lines line up for both plug and receptacle).

#### **DO NOT USE FORCE TO INSERT PLUG.**

If it doesn't slide in easily - it probably isn't aligned properly.

Turn the tightening ring on the plug to lock in place.

Plug the ACL power cord into the appropriate AC power outlet.

#### **WARNING**

*Be sure the AC voltage matches the voltage shown on the factory supplied power cord. Using a power cord on the wrong voltage may cause serious damage to the unit, as well as exposing the operator to potential electrical injury.*

Connect the weldhead cables to the rear of the ACL.

Connect the factory-supplied gas regulator to an inert gas source. Connect the shield gas input gas line coming from the gas regulator to the gas connector at the rear panel of the ACL. The factory-supplied regulator is preset, regardless of the input, to insure proper output flow and pressure.

Power-up the ACL by turning the POWER ON/OFF rocker switch to ON. The following power-up messages appear on the monitor.

#### 1.2 Logo and Program Load Screen

The ACL starts loading and initializing when the MK Products logo appears on the monitor. This screen will remain for a few seconds while the rest of the program loads, displaying a progress bar at the bottom of the screen.

### 1.3 Self Check

Once the system has completed the loading and initializing, it then performs a program self test. The purpose of this is to ensure that the welding system is functional before proceeding on with the welding. If there are any failures detected by the ACL, the monitor and the HHC will display the fault and error messages warning the operator of the pending and potential problems.

## 2. Main Screen Operations

This section will explain how to view the library of procedures, select a saved procedure, weld with that procedure, modify and override during welding and setting deviation and abort limits on the welding parameters.

There are two welding modes in the ACL unit: Production and Teach. Both of these are obtainable by turning the key switch on the front panel of the ACL. The Teach Mode (key switch in vertical position) is used primarily for weld procedure development and editing, whereas the Production Mode (key switch in horizontal position) is used for welding. The key switch is a method of "locking" the operator into the Teach Mode, so that he does not inadvertently modify, erase or copy.

While in the Teach Mode, all options on the MAIN SCREEN are available, unless deemed disabled when grayed out. In Production Mode, only those options needed by the operator are available. All the development and modifying types of options are now out of the operators' control, and he is responsible only for choosing the correct procedure and pressing the [START] button.

Unless otherwise stated, all operations discussed in this manual are from the standpoint of being in the Teach Mode, since this is where all the developing, editing, saving, erasing and copying of procedures occurs (See Section G, pages 38-39).

### 2.1 Selecting Weld Procedures

Once the ACL unit has completed its Power Up, Logo Screen and Self Check, the next visible screen is the MAIN SCREEN. From here, the operator has a variety of options to choose from: anything from welding, printing, erasing, saving, and even setting the time and date in the ACL computer.

To create a new procedure, use the APG function (see Section 2.6). From the main screen, select Programs/APG...

To view the library and select an existing procedure, from the MAIN SCREEN, select File/Open... menu or click on [Open Existing Procedure] icon on the toolbar (See Section G, page 39) or press [Main Menu] and [2 Select] on the HHC. This will show the titles of any and all weld procedures present in the library. Along with the title, or name of the procedure, its description will appear in the description box (See Section G, page 42).

Using the cursor buttons on the HHC, [ $\uparrow$ SYMBOLS], [CASE $\downarrow$ ], [ $\leftarrow$ ], and [ $\rightarrow$ ], or the arrow keys on the computer keyboard [ $\leftarrow$ ,  $\rightarrow$ ,  $\uparrow$ ,  $\downarrow$ ], the operator can move the highlighted cursor box to the weld procedure he requires.

Once the cursor box is on the procedure of choice press [ENTER], either on the HHC or the keyboard, to accept this procedure.

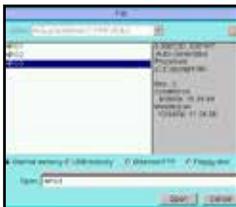
The screen will now revert back to the MAIN SCREEN with the chosen weld procedure ready for welding or modifying. The procedure name will now appear in the Weld Procedure Window of the MAIN SCREEN.



See Section G, pages 38-39 for more information



See Section G, page 39 for more information



See Section G, page 42 for more information

## **2.2 Setting Default Procedures**

The ACL has a software feature that will allow the most common weld procedure used, to be set as the default procedure. The default procedure is the one most used when other procedures are cycled through the ACL in a given days work.

To set the default procedure, choose the weld procedure from the library as described in **SELECTING WELD PROCEDURES** above, then from the MAIN SCREEN, select File/Preferences.../Advanced tab (Default Proc. entry) or press [Main Menu] and press [3 Default] on the HHC. This will allow the operator to enter the chosen procedure as the 'Default Procedure'. Once the new setting is accepted, the specified procedure will be recalled every time the welder is powered up.

## **2.3 Welding and Testing Weld Procedures**

Once a weld procedure has been loaded, the operator may now begin welding, or testing. If you are using HHC, you must first select [1 Weld] option from the Main Menu. Depending on the enabled options of the weld procedure (see **MODIFYING WELD PROCEDURES**), the ACL will ask for some data entry: Name & Headings, Serial Numbering and Serialization.

### **2.3.1 Name & Two Headings**

These three data lines can be used for the operators' name or identification number, any information that describes that particular weld and/or application, or the operator may press [ENTER] three times to accept blank lines.

All this extra information can be used to identify the operator and a series of welds to be performed.

### **2.3.2 Serial Numbers**

Press [ENTER] to accept the value shown. This option is used for serializing each individual weld with its own unique number; even test welds can be serialized. Any number, up to four digits, can be entered and used as the Serial Number.

### **2.3.3 Sequential Serialization**

Once the Serial Number is entered, the ACL will ask if the operator would like the serial numbers to become sequential. If [ENTER] or [NO] is pressed, then each weld or test weld will have the same Serial Number. If [YES] is pressed, this will cause the serial number to be automatically increased by one after each weld or test weld.

Regardless, if a series or the same serial number or if ten different serial numbers are programmed, each will be displayed on the screen for Performance Logging and on printouts for Deviation Reports.

The information above will not become an integral part of the procedure, since it will not be saved when the procedure is saved.

This information will repeat for each and every procedure loaded that has similar enabled options or, until the operator changes the data on these lines.

Even though the information is not saved with the procedure, it is however printed on the Deviation Report and Saved to Floppy disk or USB or Ethernet storage as the current Weld Log.

After all the data has been entered, the next screen will be the Weld Screen. Once at the weld screen, the operator is ready to start welding.

### **2.3.4 Modes**

On the front panel of the ACL, next to the key switch, is a green lighted-push button switch. The label for this switch is Weld (button in) and Test (button out). The operation of this push button switch does not change whether in Production or Teach Mode.

When pushed in (green light on), the Weld Mode is enabled. This will allow welding to occur during the operation of the procedure.

When pushed out (green light off), the Test Mode is enabled. In the Test Mode, the entire weld procedure can be operated **without** welding occurring.

In the top-middle of the Main Screen (Status Window), either a "W" or a "T" will appear, depending which mode (Weld or Test) is selected.

#### 2.4 Start Weld

A Weld and a Test Weld operate in the same manner except that in the Test Mode the welding arc is not initiated. Otherwise, the Test sequence performs in the same way as a weld sequence including weldhead rotation, system timing and display.

Once at the weld screen, the operator may press [START] either on the HHC or at the weldhead control (See Section G, page 43). This will start the procedure:

The first part of the weld program is the gas Pre-Purge. At this point the gas solenoid will turn on and gas will begin to flow.

If the Home Pre-Weld option is enabled, the rotor will complete two revolutions at the higher Calibration Speed (see **MOTOR CALIBRATION**), and then stop at home, prior to starting the Pre-Purge. This is done to update the calibration of the motor. If the rotor was already at the home position, it will back up slightly then begin its two revolutions.

If a Flying Start time value is given for the procedure, it will start during the Pre-Purge time and end at the same time (see Flying Start).

At the end of the Pre-Purge time, the arc will initiate. At the bottom of the monitor screen, the Voltage Bar Graph will show a bright yellow bar all the way up the graph (this is the high voltage needed to start the arc). The amount of current used in establishing the arc is set by Strike Current parameter in the Weld Procedure Window.

Once the arc voltage and current feedback sense that the arc has been initiated and is established, the weld procedure will start Level 1 (Up-slope).

In this Level current and rotor speed will initiate and start the welding arc, commence rotation of the rotor and take the procedure to its programmed welding parameters.

The actual welding portion of the procedure takes place between the Up-slope level and the end of the Final Slope level. This is called the Welding Sequence.

As the weld progresses through the weld levels, the screen shows the parameter values for the current welding level, including; time left and/or degrees left in the level, position of the tungsten around the part, the pulsing current, the resultant pulsing voltage, and the motor speed value all of which show on their respective bar graphs.

Once the welding sequence is complete, the program will finish in the Final Slope level.

This level will tail out and taper the weld so that there is no cratering effect left at the end of the weld, once the arc is extinguished.

Typically, when designing a procedure using APG, the Final Slope current will slope down while the motor will slope up.

The gas Post-Purge will start immediately after the arc is extinguished at the end of the Final Slope. It will stay on for as long as programmed.



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At the end of the Post-Purge time, the rotor will then rotate in the normal direction until it reaches home position. This will only occur if the Post-Weld Home option is enabled for the procedure. When designing a procedure from APG, this option is enabled by default.

## 2.5 Deviation Screen, Report & Log

Once the weld finishes, the rotor returns to home position and the gas has stopped flowing, the weld log will appear on the screen; and if enabled it will also print and/or save to disk.

This weld log contains all needed information concerning the status of the completed weld. When used in conjunction with the Data Monitoring option (see **MODIFYING WELD PROCEDURES**) this log will produce a report on the screen showing all the deviations that occurred during the entire Weld, or Test operation.

A weld log will appear on the screen after each and every weld. A printout of the weld log, a Deviation Report will generate only if either the Print All Logs or Print On Error options are enabled.

The weld log consists of several items of pertinent information: Procedure Name and Description; Name & Two Headings; Applied Current and/or Motor Scaling; Weld Serial Number; Total Number and Type of Deviations Detected; Procedure and Abort Limit Values (if programmed).

The number of deviations may be large or small, depending on the type of deviation detected. Both the screen and the printout will show the first fifteen deviations, and the absolute last one.

If an Abort Limit caused the last deviation, the top of the deviation report would show that the weld was aborted. The last deviation, if it is greater than the sixteenth, would show exactly what type of deviation occurred to abort the weld.

Each procedure can be modified to not only print, but also save the weld log at the completion of the weld.

In order to save each and every weld log, or just the weld log of those that had deviations, at the options screen for the procedure enable either of the two Save Log functions.

Saving a weld log requires the operator to insert an already formatted diskette (1.44MB) into the floppy disk drive or to use USB or Ethernet storage.

When the weld finishes, and during the time the weld log appears on the screen, the information will also be transferred to the disk.

At this point, if saving the information is still required, revert to the LOG MENU and save the current weld log from there (see **LOG MENU OPERATIONS**). If it is not required to save this weld log, the operator may start another weld, at which point the current weld log will be erased in order to make room for the next weld log.

## 2.6 Auto-Procedure Generation (APG)

The Auto-Procedure Generation (APG) option enables the operator to utilize the ACL to generate a weld procedure from a description of the weld to be performed. This weld procedure, which is usually very close to the ideal procedure, may then be adjusted and/or modified to obtain optimum welding performance.

Prior to using this option, determine whether the procedure is to be designed using either Standard (SAE) or Metric (SI) Units. The Auto-Procedure Generation Information Screen is the only screen that utilizes either units of measure. While the parameters and resultant procedure variables are ultimately the same, it is the description that varies with the units selected



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The APG dialog, which is available by selecting Programs/APG... on the MAIN SCREEN or [Main Menu] and [4 APG] on the HHC, is enabled only in the Teach Mode. If a weld procedure is already loaded, the next question asks if that procedure should be discarded (See Section G, page 41).

The Auto-Procedure Generation dialog asks a couple of basic questions before the rest of the APG dialog window is shown. It is at this window that all pertinent variables are inputted and used for weld procedure generation, like Tube O.D. (up to 5.5"), Wall Thickness (up to 0.200"), Number of Tacks (up to 8), Number of Levels (up to 90), and Travel Speed (ipm - maximum based on tube diameter).

#### **2.6.1 English/Metric**

When English option is selected, the units of measure will be in inches.

When Metric option is selected, the units of measure will be in mm.

#### **2.6.2 Tube/Pipe**

When Tube option is selected, the standard Tube sizes for selected units will be used when using tube sliders.

When Pipe option is selected, the standard Pipe sizes for selected units will be used.

#### **2.6.3 Tube O.D. / Pipe Size**

This maximum is based on the largest sized weldhead available. The ACL unit does not need to know the size of the weldhead it welds with; it uses a correlation between tube diameter and travel speed (ipm) to calculate a rotational speed (rpm) of the tungsten.

#### **2.6.4 Wall Thickness / Pipe Schedule**

The maximum output of the ACL Welding Power Supply is 200 amps; the ACL is programmed to give one-amp for every one-thousands material thickness. For these reasons, the maximum wall thickness input possible is two hundred thousands.

The following options are shown only when Advanced... button is pressed.

#### **2.6.5 Travel Speed**

This is the only screen in which you will see the travel speed with a value of inches-per-minute (ipm). All other travel speed values in this program use rpm. The travel speed in rpm is derived by dividing the travel speed in ipm, by the circumference (which is calculated from the tube diameter).

#### **2.6.6 Weld Levels**

Whether designing a regular procedure or a degree procedure, the circumference of the tube will be evenly cut into slices that correlate to the number of levels chosen, excluding the Up Slope and Final Slope levels.

#### **2.6.7 Tacks**

When this option is utilized, the ACL program will generate a current value and a length of time for each tack, which is in relation to the tube diameter and wall thickness. For thicker materials, longer and hotter tacks while thinner materials get a shorter and colder tack.

All tacks programmed from this auto tacking function, will occur at opposing intervals around the tube. These tacks are not programmed into the procedure as levels, but exist as opposing intervals of degrees, occurring after the Pre-Purge and prior to initial arc strike.

#### **2.6.8 Wire Diameter**

Not used at this time.

#### **2.6.9 Weld Start Position**

When checked, you can specify the position (in degrees) where welding should start if other position is more appropriate instead of the 'Home' position normally used.

### 2.6.10 Sloping Current

A sloping current procedure is designed to allow for heat input, starting from the beginning of the weld and going to the last level before the final slope.

If a sloping current procedure is chosen, the ACL computer will automatically calculate how much heat is needed at the beginning and end of the weld. It will then assign decreasing current values for all levels of the procedure as well as a current slope for each level, meaning that each level has a different starting and ending current.

Without current sloping, the ACL will assign one constant set of current values for the entire procedure, except for the final slope.

### 2.6.11 Degree Procedure

A degree procedure is one based on a circumference of degrees and not inches or millimeters. Each level is exactly a certain number of degrees and not a certain number of seconds. Similarly, each level is programmed to end at a set degree and not when time runs out.

If a degree procedure is chosen, certain conventions must be remembered when modifying and developing; such as motor speed scaling versus rotational travel and level jumping versus level termination (see **MODIFYING WELD PROCEDURES**).

Declining a degree procedure will default the APG to make a standard time based procedure.

### 2.6.12 A/C Welding

When this option is enabled, the APG will generate a program with straight and reverse pulses used to control a Variable Polarity A/C Adapter.

### 2.6.13 Data Monitor

When this option is enabled, the ACL will flag readings outside of the specified range. This is useful for quality control and verification of welding performance.

When all the values for the weld procedure have been entered and Accepted, the program will return to the MAIN SCREEN.

Since this procedure has just been made, the program gives it the name TRIAL--. At this point the operator may choose to save this procedure with a valid name (see Saving Weld Procedures below), or continue with modification, editing, testing and/or welding and save at a later time in the program.

## 2.7 Saving Weld Procedures

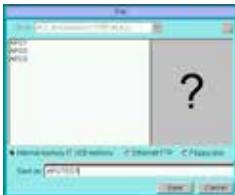
Once a weld procedure has been designed, tested welded and modified to exact standards as required by either the Welding Engineer, the Operator and/or the Customer and his specification, it is generally a good idea to save the procedure for future use (See Section G, page 47).

### 2.7.1 Saving to Library

The first step in saving a procedure is to name it. At the MAIN SCREEN, select File/Save As... menu or click on [Save As] icon on the toolbar or press [Main Menu] and [6 Save] on the HHC. This will allow you to enter up to seven characters to name the procedure.

Both numbers and letters (only upper case) can be used to name the procedure. **DO NOT USE SYMBOLS.**

Enter the desired name for the procedure, then press [ENTER]. Once entered, the procedure name in the Weld Procedure Window of the MAIN SCREEN will change and show the new procedure name in place of the name "TRIAL--".



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If the procedure to be saved is given a name of an already existing procedure, when [ENTER] is pressed, the program will notify the operator and ask if to replace the existing procedure. Answering [YES] will override the existing procedure with the new procedure.

### **2.7.2 Saving to Disk**

Saving procedures to disk is the same as saving to the library except the disk type (Floppy/USB/Ethernet) must be changed before the Save operation is selected.

## **2.8 Erasing Weld Procedures**

When a weld procedure is no longer used and necessitates being erased, from the MAIN SCREEN, select File/Delete... menu or click on [Delete] icon on the toolbar or press [Main Menu] and [7 Erase] on the HHC. This option will erase any and all the procedures currently saved in the library.

### **2.8.1 Erasing From Library**

Select the procedure from the list or enter the name of the procedure to delete and accept delete operation.

### **2.8.2 Erasing From Disk**

Erasing procedures from disk is the same as erasing from the library except the disk type (Floppy/USB/Ethernet) must be changed before the Delete operation is selected.

## **2.9 Modifying Weld Procedures**

This section details the steps by which to create a new weld procedure or modify an existing procedure, save a new or modified procedure into memory, and erase a saved procedure from memory. The functions are only accessible while in the TEACH MODE.

A pre-programmed weld procedure is a sequence of welding functions performed over a synchronized time schedule or segmented degrees. With an automatic weld procedure the ACL can weld with a given current and weldhead rotor speed over a period of time, or for a given number of degrees. The ACL software will also allow the operator to program a procedure with multiple time levels or levels of a certain number of degrees.

Within these levels the current and weldhead rotor speed can be made to pulse between high and low values and to slope over a given range. Additionally, the operator can specify the homing characteristics of the rotor both before and after the weld, whether data monitoring should be performed and to what tolerances, whether a starting point should be defined, how reports are to be printed, and whether AC welding is to be performed.

From the MAIN SCREEN, select Programs/MK Edit... menu or click on [Edit] icon on the toolbar or press [Main Menu] and [5 Modify] on the HHC to open the Procedure Edit dialog which allows the operator to change all the parameters and variables in a weld procedure or create a new procedure altogether. When creating a new procedure, select one that is most like it, and substitute new values for those already present, or start with the basic procedure (————) by selecting File/New/Empty from the Main Screen and start from scratch.

When modifying a procedure, the Procedure Edit dialog will allow modification and editing (See Section G, page 44):

All references to entered values in this section will pertain to a time based weld procedure. A description of a degree based weld procedure will immediately follow this section.

### **2.9.1 Weld Record Tab**

A total of four ID lines, sixteen characters per line, are available for weld procedure identification, instructions, or messages. Even though data is



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not required, the operator could leave these lines blank if he chooses, they are to help identify and describe each and every procedure. They will not affect the operational ability or performance function of the weld procedure, but they will show on all printouts.

Pressing [ENTER] will move the cursor box to the next line, top to bottom, accepting either a blank line or the typed information. Once all the lines are filled, or entered and accepted, pressing [ENTER] once again will continue to the next option.

Next, you can enter and modify the pre- and post-weld parameters for each weld procedure. These features include Max Scale allowed, Pre-Purge gas time, Strike Current value, number of tacks and Post-Purge gas time.

#### **2.9.1.1 Maximum Scale Change**

This value limits the amount, by percentage, by which both the Current and Motor Speed may be scaled, either up or down. This value should be large to allow for compensations of expected variations in material and welding conditions, but not so large that control of the welding process is lost.

This value has no effect unless the ACL system is in Production Mode (see WELDING OPERATIONS in this section).

#### **2.9.1.2 Pre-Purge Time**

This is the amount of time that the purge gas will flow prior to starting the welding arc. Valid values are from 0.02 to 300.00 seconds.

#### **2.9.1.3 Strike Current**

This is the current value at which the arc will strike and initiate an arc. Valid values are from 5.0 to 25.0 amps.

#### **2.9.1.4 Tacks Number**

This value determines how many tacks are required around the circumference of the item to be welded. Multiple tacks will occur at opposing points with the last tack opposite Home or the programmed Start Position. Valid values are from 0 to 8 tacks. The tack parameters are specified in the Advanced Tab.

#### **2.9.1.5 Post-Purge Time**

This is the amount of time that the purge gas will flow once the welding arc has extinguished, regardless if the procedure has fully completed or whether the operator has prematurely halted the procedure by pressing [STOP]. Valid values are from 0.02 to 300.00 seconds.

#### **2.9.1.6 Procedure Levels Information Table**

Level 1 of each procedure is considered the Up Slope Level; in this Level current and rotor speed will initiate and start the welding arc, commence rotation of the rotor and take the procedure to its programmed welding parameters.

Level 2 and subsequent Levels' hereafter, are considered Weld Levels. The previous Up-Slope Level simply initiated and started welding; these next Levels will be programmed to perform the actual welding of the tubes, fittings, and parts. Up to 90 levels are available (excluding the Final Slope Level) for entering and modifying welding parameters.

The welding parameter values have the same function as in Level 1.

Once the Weld Level data has been entered and/or modified, the ACL program will automatically move to the next subsequent Level.

The Final Slope Level (marked as \*\*) is considered part of the weld procedure, but it does not perform any welding. The function of the Final Slope Level is to slope the welding current and travel speed in order to eliminate detrimental effects produced by the heat of the welding arc, and

to leave a weld bead which is visually more appealing to inspectors and other first line inspection personnel.

When the cursor box is at the Level Number the parameters for that Level will show underneath. Changing Levels can be done in several ways: enter the number of the Level to be viewed then press [ENTER], or press [PAGE DOWN] to scroll to the next Level or [PAGE UP] to scroll to the previous Level.

Using the cursor buttons on the HHC [PAGE UP], [PAGE DOWN], [↑SYMBOLS], [CASE↓], [←], and [→], or the arrow keys on the computer keyboard [← → ↑ ↓] or [ENTER] on either, the operator can move the highlighted cursor box to enter and/or modify each and every procedure parameter, such as Level Time, Current Slope and Motor Slope, as well as Pulse Times, Current and Motor Speeds for both High and Low values.

With a pulsing procedure (High Pulse is not zero), the cursor will move from the High values to the Low values, then down to the A/C values. This will cause the ACL to alternate polarities from reverse to straight, while the whole time pulsing the current.

With a non-pulsing procedure (High Pulse is zero), the Low values disappear and the cursor moves from the High values to the A/C values. This will cause the ACL to only alternate polarities from reverse to straight.

The Low values of the weld procedure parameters are requested only if there is pulsing (High Pulse is not zero). The following Low Pulse values are requested.

#### **2.9.1.6.1 Level Time**

This is the total length of time for the Level. Valid values are from 0.00 to 300.00 seconds. If 0.00 is entered, no other values will be allowed and the Level will be deleted when exiting the modification option.

#### **2.9.1.6.2 Current Slope**

For the Up-slope level, this is the time the Current will take to slope from the Strike Current to the current value in this Level.

For other levels, this is the time the Current will take to slope from the current in the previous Level to the current value in this Level.

Valid values are from 0.00 to 300.00 seconds. The Current Slope time cannot be longer than the total Level Time, if a longer time is entered, the program will automatically adjust the entry to match that of the total Level Time.

#### **2.9.1.6.3 Motor Slope**

For the Up-slope level, this is the time the Motor will take to slope from zero (or the Pre-Motor Speed) to the Motor Speed value in this Level.

For other levels, this is the time the Motor will take to slope from the speed in the previous Level to the Motor Speed value in this Level.

Valid values are from 0.00 to 300.00 seconds. The Motor Slope time cannot be longer than the total Level Time, if a longer time is entered, the program will automatically adjust the entry to match that of the total Level Time.

#### **2.9.1.6.4 High Pulse Time**

This time specifies the length of time each high pulse value in this Level. Valid values are from 0.00 to 9.99 seconds. If 0.00 seconds is entered, the Low Pulse values will not be available and this Level will not pulse. The High Pulse time cannot be longer than the total Level Time, if a longer time is entered, the program will automatically adjust the entry to match that of the total Level Time.

#### **2.9.1.6.5 Low Pulse Time**

This time specifies the length of time each high pulse value in this Level. Valid values are from 0.00 to 9.99 seconds. The Low Pulse time cannot be longer than the total Level Time, if a longer time is entered, the program will automatically adjust the entry to match that of the total Level Time.

#### **2.9.1.6.6 High Current**

This is the constant current value of this Level if there is no Current Slope Time or no pulsing. If sloping exists, then this value is the final High Pulse Current value for this Level at the end of the Current Slope Time. If there is current pulsing, then this is the High Pulse Current value of the Level. Valid values are from 0.00 to 200.00 amps.

#### **2.9.1.6.7 Low Current**

This is the constant current value of this Level if there is no Current Slope Time or no pulsing. If sloping exists, then this value is the final Low Pulse Current value for this Level at the end of the Current Slope Time. If there is current pulsing, then this is the High Pulse Current value of the Level. Valid values are from 0.00 to 200.00 amps.

#### **2.9.1.6.8 High Motor Speed**

This is the constant value of the motor speed in this Level if there is no Motor Slope Time or no Step-Pulsing. If sloping exists, then this value is the final High Motor Speed value for this Level at the end of the Motor Slope Time. If there is Motor Step-Pulsing, then this is the value associated with the High Pulse value of the current. Valid values are from 0.00 to 10.00 rpm.

If the A/C Welding option is enabled, in the Procedure Options Screen, the cursor box will move from the weld procedure parameters to the A/C (Reverse and Straight) weld parameters.

#### **2.9.1.6.9 Low Motor Speed**

This is the constant value of the motor speed in this Level if there is no Motor Slope Time or no Step-Pulsing. If sloping exists, then this value is the final Low Motor Speed value for this Level at the end of the Motor Slope Time. If there is Motor Step-Pulsing, then this is the value associated with the Low Pulse value of the current. Valid values are from 0.00 to 10.00 rpm.

#### **2.9.1.6.10 Straight Polarity**

Normal welding of the ACL is done using Straight Polarity: when the electrical current flow is from the tungsten electrode (positive) to the work piece (ground). Valid values are from 0.1 milliseconds to 400.0 milliseconds.

#### **2.9.1.6.11 Reverse Polarity**

When using Reverse Polarity, the electrical current flow is from the work piece (ground switched to positive) to the tungsten electrode (positive switched to ground). Valid values are from 0.1 milliseconds to 200.0 milliseconds.



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### **2.9.2 Weld Data Tab**

This tab contains many fields used to describe the procedure. This information is saved with the procedure but is only used for documenting and printing and is not necessary for welding (See Section G, page 45).

### **2.9.3 Advanced Tab**

This tab is used to enable A/C Welding, set Flying Start values (time and speed of rotation), set number of tacks and their parameters, enable and set Weld Start Position, set a value on the amount of scaling allowed to the operator during a weld, many other advanced features as well as setting deviation logging and abort tolerances on the weld procedure

parameters; high and low values for current, voltage, and motor speed (See Section G, page 46).

#### **2.9.3.1 A/C Procedure**

If checked, this option enables A/C welding using A/C welding Str./Rev. procedure parameters and control of external VPAC unit.

#### **2.9.3.2 Flying Start Pre-Motor Run Time**

This is the amount of time the rotor will rotate prior to striking the arc, also known as a "Flying Start". This time value cannot be longer than the Pre-Purge time, and the ACL program will prevent a higher value from being entered.

A positive value will cause the rotor to slope up to the Pre-Motor Speed, while a negative value will delay the rotor by the time value and then cause it to proceed at the Pre-Motor Speed. Valid values are from 0.00 to 99.00 seconds.

#### **2.9.3.3 Flying Start Pre-Motor Run Speed**

This speed is what the rotor is to run at before striking the arc. It is used in conjunction with the Pre-Motor Run Time. If the Pre-Motor Run Time is zero the Pre-Motor Run Speed is not available.

#### **2.9.3.4 Tacks Number**

This value determines how many tacks are required around the circumference of the item to be welded. Multiple tacks will occur at opposing points with the last tack opposite Home or the programmed Start Position. Valid values are from 0 to 8 tacks.

#### **2.9.3.5 Tack Time**

This value defines the duration of each tack. Valid values are from 0.5 to 5.0 seconds. If no tacks are requested the tack time will not be available.

#### **2.9.3.6 Tack Current**

This value defines the heat intensity of the tack. Valid values are from 1.0 amp to the maximum amp value in the procedure. If no tacks are requested the tack current will not be available.

#### **2.9.3.7 Weld Start Position & Start Position**

Start Position degree setting is only available if the Weld Start Position option is checked. Otherwise, this value is ignored.

This value defines the position, in degrees clockwise (normal forward rotating direction of the rotor) from the Home position, that the procedure will start welding. This assumes the weldhead is held in the vertical position with the rotor opening at the top and the tungsten at about the three o'clock position.

If the welding is to start at Home, the Start Position value should be zero. If the welding is to start at the bottom of the weldhead, a value of ninety should be entered.

When Start Position is enabled, the ACL program requests an additional Head angle parameter on the MAIN SCREEN. This additional parameter, "Weldhead Angle", is the degree angle of the weldhead from the vertical.

When the procedure is started, following the Pre-Purge, the rotor will move to the specified Start Position plus the added Weldhead Angle value. When used with the tacking feature, the final tack will occur opposite the Start Position, the added Weldhead Angle simply adjusts for the orientation of the weldhead position

This feature is available only if the Start Position option has been enabled.

### **2.9.3.8 Maximum Scale Change**

This value limits the amount, by percentage, by which both the Current and Motor Speed may be scaled, either up or down. This value should be large to allow for compensations of expected variations in material and welding conditions, but not so large that control of the welding process is lost.

This value has no effect unless the ACL system is in Production Mode (see WELDING OPERATIONS in this section).

### **2.9.3.9 Procedure Options**

This area displays a list of enabled options that are unique to each and every procedure. The options that are checked are the currently selected options for the procedure being modified.

### **2.9.3.10 Current Deviation (Tolerance)**

These are limits (tolerances) set on the high and low current pulse values of the weld procedure. Limits are set as a percentage of the actual demand value along with an amount of time allowed for the current to exceed the limit.

If the current and time feedback from the welding arc should exceed the limit, then a deviation will be logged and printed, if the procedure is programmed to do so.

### **2.9.3.11 Current Abort (Abort Tolerance)**

These are abort limits (tolerances) set on the high and low current pulse values of the weld procedure. The abort limits are set as a percentage of the actual demand value along with an amount of time allowed for the current to exceed the limit. Typically these abort limits are greater than those of the current limits, thus extending or allowing more of a deviation before aborting the weld.

Should the current and time feedback from the welding arc exceed the abort limit, the weld will automatically abort and an abort deviation will be logged and printed, if the procedure is programmed to do so.

### **2.9.3.12 Motor Speed Deviation (Tolerance)**

These are limits (tolerances) set on the high and low motor speed values of the weld procedure. Limits are set as a percentage of the actual demand value along with an amount of time allowed for the motor speed to exceed the limit.

Should the motor speed and time feedback from the motor tachometer feedback exceed the limit, then a deviation will be logged and printed, if the procedure is programmed to do so.

### **2.9.3.13 Motor Speed Abort (Abort Tolerance)**

These are limits (tolerances) set on the high and low motor speed values of the weld procedure. The abort limits are set as a percentage of the actual demand value along with an amount of time allowed for the motor speed to exceed the limit. Typically these abort limits are greater than those of the motor speed limits, thus extending or allowing more of a deviation before aborting the weld.

Should the motor speed and time feedback from the motor tachometer feedback exceed the abort limit, the weld will automatically abort and an abort deviation will be logged and printed, if the procedure is programmed to do so.

### **2.9.3.14 Voltage Deviation (Tolerance)**

These are absolute limits (tolerances) set on the welding arc voltage. The limits that exist on the maximum and minimum voltage values are allowed.

If the voltage and time feedback from the welding arc should exceed the limit, then a deviation will be logged and printed, if the procedure is programmed to do so.

#### **2.9.3.15 Voltage Abort (Abort Tolerance)**

This is an absolute abort limit (tolerance) set on the welding arc voltage. The abort limits exists on the maximum and minimum voltage values allowed.

If the voltage and time feedback from the welding arc should exceed the abort limit, then a deviation will be logged and printed, if the procedure is programmed to do so.

### **3. Keyboard Functions**

The factory supplied PC keyboard can be used to fully operate the ACL welding program. Not only are the keys on the keyboard used for entering text and numbers but many are also utilized as program function commands.

Described in the sections below are the many keystrokes used on the keyboard.

#### **3.1 Menu Keys**

Pressing the corresponding key on the factory supplied computer keyboard can bring each MENU forward.

#### **3.2 Acceptance Keys**

Once a value has been entered, but not 'accepted' at the active highlighted field, the operator may 'clear' the entry by pressing [DELETE] or [BACKSPACE]. Using this combination will also clear a line of text prior to typing.

As described above, while at the weld screen, in the editing/modifying mode or, at any other screen, pressing [Esc] will abort changes.

Use the [Y] and [N] keys to confirm and accept, or decline and negate any values in the highlighted field. They will also answer questions prompted on the screen during the program.

The [Enter] or [Return] key, is used similarly as the [Y] and [N] keys. This key will accept any values entered and those that are defaulted. When answering questions, this key will perform the same functions as [N], thus declining to change what the questions ask to change.

#### **3.3 Cursor Keys**

These four keys will help move through the entries during editing/modifying of procedures or drop down menus or tabs.

While editing a weld procedure, the cursor keys [←, →, ↑ and ↓], will move the cursor to the next available field for data entry or edit except in numeric fields when [↑, ↓] increase/decrease numeric value.

#### **3.4 Text, Symbol & Numeric Keys**

There are sections of the ACL program that will require or request text, symbols and/or numerals to be entered. This will range from a weld procedure name (either to be saved or recalled) to a procedure description to weld parameters.

Several keys have a single- or dual-function; depending on which part of the ACL program screen is currently showing.

The text keys are only active when the cursor line lies within a text line.

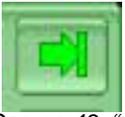
For example: If the MAIN SCREEN is showing, and the operator is attempting to save a procedure, the save procedure dialog box will show and await the operator to type in a procedure name. At this time, all the text and numeral keys are active.



See pg 43, #5



See pg 43, #2



See pg 43, "A"



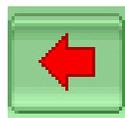
See pg 43, #1



See pg 43, #4



See pg 43, "B"



See pg 43, "C"

If at the MAIN SCREEN (weld screen), the text keys will become ACL program function keys.

When modifying a procedure, and the cursor line is located at the weld procedure description, all key functions are in text entering mode only.

### 3.5 Welding Function Control Keys and Clickable Icons

These are the keys that control the welding procedure operations prior to and during welding or testing.

Use the [S] key or click on [START/STOP] icon to start/stop the procedure.

When pressed, while viewing the Weld Screen, the loaded procedure will start.

If pressed during the welding or testing of the welding procedure, the procedure will stop.

Use the [Home] or [F] keys or [FINAL SLOPE] or [HOME] icons to proceed with final slope or home function.

If pressed during the welding or testing of the welding procedure, all levels will skip and initiate the Final Slope.

If pressed at any other time while at the Weld Screen, the rotor will move (jog) to its home position at the high calibration speed value. If the rotor is already at home position, the rotor will then backup several degrees, then forward again to home.

If using a Degree procedure, pressing the [Home] or [F] keys will immediately start the next level and will not finish until it reaches the programmed position of that level.

Use the [N] key or [NEXT LEVEL] or [GAS] icons to proceed with next level or gas functions.

If pressed during the welding or testing of the welding procedure, the procedure will jump from its current procedure level to the next procedure level.

Subsequent pressing of this key will continue to jump to the next levels of the procedure until the Final Slope is reached.

If using a Degree procedure, pressing the [N] key will immediately start the next level and will not finish until it reaches the programmed position of that level.

Pressing [N] key or gas icon prior to starting the procedure will cause the Arc Gas and Backup Gas (if connected) to start flowing. The gas will not turn off until this, or another gas key is pressed again.

If the gas flow is off, the inert shielding gas will automatically turn on ('flow') once the procedure is started by pressing the [S] key.

In order to jog the rotor, either prior to or after running the procedure, use the combination of [Shift + 6] or [Shift + 7] or Jog Forward/Reverse icons for forward or reverse rotation, respectively.

To jog the rotor in the normal welding direction (clockwise direction), press [Shift + 6] or Jog Forward icon. To jog the rotor in the opposite (counter-clockwise) direction, press [Shift + 7] or Jog Reverse icon.

Either key will jog the rotor in their respective directions, at a speed of 5 rpm.

### 3.6 Scaling Keys

During the welding and testing mode, the operator may scale both the current and rotor speed values as the procedure allows. This can be accomplished using the cursor keys.

The up [↑] and down [↓] arrow keys, when pressed, will increase or decrease the amperage value, before or during the welding and testing, by one percent (1%) of the current level value.

For example: If the amperage value for the current level is 50 amps, and the [↑] is pressed five times to increase the amperage five percent (5%), then the actual current value at the arc will be:

$$50 + 5\%(50) = 52.5 \text{ amps}$$

$$50 + 2.5 = 52.5 \text{ amps}$$

The left [←] and right [→] arrow keys, when pressed, will increase or decrease the rotor speed value, before or during the welding and testing, by one percent (1%) of the current level value.

For example: If the rotor speed value for the current level is 5 rpm, and the [←] is pressed five times to decrease the rotor speed five percent (5%), then the actual rotor speed value at the tube surface will be:

$$5 - 5\%(5) = 4.75 \text{ rpm}$$

$$5 - 0.25 = 4.75 \text{ rpm}$$

If any these keys are held down continuously, the percentage value will climb, or fall, as long as the key is held.

Each procedure has a Maximum Scale Change Limit that was programmed when the procedure was developed (see **MODIFYING WELD PROCEDURES**). The procedure will not let you exceed that Scale Limit while in the 'Production Mode'.

At the Weld screen, pressing the [Ctrl + L] key will zero all the Scale factors applied to the procedure, so the procedure runs as programmed.

## 4. Hand Held Control (HHC) Operation

### 4.1 Menu Buttons

Across the top of the HHC keypad, there are separate buttons for each of the MENUs in the ACL. Pressing the corresponding button on the HHC, or on the factory supplied computer keyboard can bring each MENU forward.

Using the HHC, to access the "MAIN MENU", the "PRINT MENU" and the "LOG MENU", press one of the blue buttons across the top of the HHC.

To access the "MAIN MENU", the "PRINT MENU" and the "LOG MENU", press the corresponding key that matches the requested MENU, as seen at the bottom of each of the MENU screens.

Using [Esc] on the keyboard is the only way the "MAIN MENU" can be accessed.

Use [P] for the PRINT MENU.

Use [L] for the LOG MENU.

The MAIN MENU can be accessed by pressing either [MAIN MENU] at the top, or [ESCAPE] at the bottom of the HHC.

### 4.2 Acceptance Buttons

The five buttons at the bottom of the HHC keypad are primarily used to affirm, negate, select and accept data that has been entered.

The [CLEAR] button in blue is used to remove an entered value, which has not yet been accepted. Once a value has been entered, but not 'accepted' at the active highlighted field, the operator may 'clear' the entry simply by pressing [CLEAR]. In the welding and testing mode, pressing the [CLEAR] button will zero all the Scale factors applied to the procedure, so the procedure runs as programmed.

The [ESCAPE] button in blue has primarily the same functions the [Esc] button has on a standard PC keyboard. As described above, while at the weld screen, in the editing/modifying mode or, at any other screen, pressing this key will return to the MAIN MENU.

Both the [YES] and [NO] buttons which are blue, are used to confirm and accept, or decline and negate any values in the highlighted field. They will also answer questions prompted on the screen during the program.

The [ENTER] button in green, is used similarly as the [YES] and [NO] buttons. This button will accept any values entered and those, which are defaulted. When answering questions, this button will perform the same functions as [YES] or [NO], depending on the shown default.

#### **4.3 Cursor Buttons**

These six buttons will help move through the program during editing/modifying of procedures.

When editing a weld procedure in the [5 Modify Procedure —] option, the [PAGE UP] and [PAGE DOWN] both in orange, will move the cursor to the next section of values to be entered or edited. These buttons will also scroll through the editing screens forward or backward, except when editing text entries. Then [PAGE UP] and [PAGE DOWN] from the HHC keypad will accept the text characters assigned to each button. When using the keyboard, there is no conflict with these buttons.

While editing a weld procedure, the arrow buttons [↑SYMBOLS], [CASE↓] in orange, and [←], [→] in blue, will move the cursor to the next available field for data entry or edit.

#### **4.4 Text/Symbol Buttons**

There are sections of the program that will require or request text to be entered. This will range from a weld procedure name (either to be saved or recalled) to a procedure description. The program will show a line of text by displaying the length of the text available on this line. This is shown with underlines ( \_ ) on the HHC display. This function can be easily performed using the factory supplied PC computer keyboard, however; this exact same function can also be performed using the HHC. This may be preferable, in that the keyboard does not need to be connected for the system to operate, and it can be stored out and away from the work environment. For others, the keyboard is a much easier and faster method of entering text and symbols.

Unlike a standard PC computer keyboard, every button on the HHC is used for entering, editing and/or deleting text (both upper and lower case) and text symbols, known as punctuation marks and mathematical signs. Those buttons with a white letter in a black box, at the upper left-hand corner of each button on the HHC, are used to enter text. Opposite these letters, in the upper right-hand corner are the available text symbols.

To maximize the usage of the keypad, many buttons have a single- or dual-function program button, as well as a text and symbols function. The text buttons will not become active unless the highlighted cursor box is within a field that will accept text and/or a symbol.

For example: If when in the editing/modifying mode, the cursor box is located at a weld parameter field, none of the text characters will be active. If one of the text buttons is pressed, only the other function of the button will occur.

However, if at a text line, only the text characters will be active. The text buttons are now active, and once pressed will 'type' that text character or symbol.

All text is defaulted to be upper case, should a lower case letter be required on the text line, simply press the [CASE↓] button once. After pressing this

button, all text characters entered will be lower case. To return to the upper case letters, press the [CASE↕] button once again, this will toggle the lower case letters to the upper case letters.

For example: If typing the word "Weld" at a text line, follow this procedure... Press the 'W' [↕%MOTOR], followed by [CASE↕] (for lower case letters) then finish with the letters 'E' [HELP], 'L', and 'D' [PRINT MENU], then press [ENTER]. This will complete the line and look like this... Weld.

The next subsequent line will start of with upper case letters, since it is a new line of text.

In order to place a space between words or symbols is to press [→], then continue typing. This will add a space as the text is being typed on the line.

If the [→] was not pressed and a space is required, there is no 'Backspace' or 'Delete' button on the HHC. The [→] button will not add a space, or over-type a letter with a space. The simplest method to add a space to the already typed text, is to clear the line using [CLEAR], then re-type the line.

If any of the text symbols need to be placed on a text line, either as part of the weld procedure name or procedure description, this too is easily done with the HHC keypad. Many of the same text buttons used for typing also contain a symbol character; these are obtainable by first pressing [↑SYMBOLS] followed by the required button.

For example: If a '#' symbol needs to be added to the line developed above, move the cursor to the end of the word using [→] button. Followed by [↑SYMBOLS] **once**, then by '#' [↑%CURRENT], then [ENTER]. This will finish the line... Weld#.

All text buttons are defaulted to the available text character; should a series of text symbols be required on the text line, simply press the [↑SYMBOLS] button once. After pressing this button, all text symbol buttons pressed will type that symbol. To return to the text characters, press the [↑SYMBOLS] button once again, this will toggle from the text symbols to the text characters.

#### **4.5 Numeric Buttons**

The white buttons in the middle of the HHC keypad, are used for numerical data entry. These buttons are active any time the highlighted cursor box is on a text line field, weld procedure parameter line, or at any other point in the program which requires a number value or numerical identification.

These buttons are single function only, meaning that there are no other functions connected to these buttons, which may confuse or distract the operator.

#### **4.6 Service Buttons**

In the upper right-hand corner of the HHC keypad are two blue buttons, these are [HELP] and [PRINT SCREEN].

The [HELP] button will aid the operator in giving an explanation, on screen, of most program functions. This information can only be viewed on MAIN SCREEN.

The [PRINT SCREEN] button will allow the operator to produce, on the factory-supplied printer, a hard copy printout of exactly what is on the screen. This button can be pressed at any time during the welding and testing operation in order to produce this printout.

#### **4.7 Welding Function Control Buttons**

These are the buttons that control the welding program operations prior to and during welding or testing, and during weld procedure editing/modifying.

The red [START/STOP] button first starts the program. If pressed a second time, it will stop the program.

The [FINAL SLOPE/HOME] button in orange, if pressed during the welding or testing of the welding program, will skip all levels and initiate the final slope. If pressed at any other time, the rotor will move (jog) to its home position at the high calibration speed value. If the rotor is already at home position, the rotor will then backup several degrees, then forward again to home.

If using a Degree procedure, pressing the [FINAL SLOPE/HOME] button will immediately start the final level and will not finish until it reaches the programmed end.

The [NEXT LEVEL/GAS] button in orange, if pressed during the welding or testing of the welding program, will jump from its current program level to the next program level. Subsequent pressing of this button will continue to jump to the next levels of the program.

If using a Degree procedure, pressing the [NEXT LEVEL/GAS] button will immediately start the next level and will not finish until it reaches the programmed end.

If pressed at any other time, the gas function is enabled: if pressed once, the gas will 'flow' (assuming the inert gas supply and the weldhead gas lines are connected to the ACL), if pressed again the 'flow' of gas will stop.

The inert shielding gas will automatically turn on ('flow'), when the program is started by pressing the [START/STOP] button.

The two green buttons [↑JOG] and [↓JOG], are used to jog the rotor either prior to starting the program for setup, or after running the program.

To jog the rotor in the normal welding direction (clockwise direction), press [↑JOG]. To jog the rotor in the opposite direction, press [↓JOG].

Either button will jog the rotor in their respective directions, at a speed of 5 rpm.

#### **4.8 Scaling Buttons**

During the welding and testing mode, the operator may scale both the current and rotor speed values as the procedure allows. This can be accomplished with the four buttons described below.

The two red buttons labeled [↑%CURRENT] and [↓%CURRENT], when pressed, will increase or decrease the amperage value, before or during the welding and testing, by one percent (1%) of the current level value.

For example: If the amperage value for the current level is 50 amps, and the [↑%CURRENT] is pressed five times to increase the amperage five percent (5%), then the actual current value at the arc will be:

$$50 + 5\%(50) = 52.5 \text{ amps}$$

$$50 + 2.5 = 52.5 \text{ amps}$$

The two green buttons labeled [↑%MOTOR] and [↓%MOTOR], when pressed, will increase or decrease the rotor speed value, before or during the welding and testing, by one percent (1%) of the current level value.

For example: If the rotor speed value for the current level is 5 rpm, and the [↓%MOTOR] is pressed five times to decrease the rotor speed five percent (5%), then the actual rotor speed value at the tube surface will be:

$$5 - 5\%(5) = 4.75 \text{ rpm}$$

$$5 - 0.25 = 4.75 \text{ rpm}$$



See Section G, pages 39 and 48 for more information

If any these buttons are held down continuously, the percentage value will climb, or fall, as long as the button is held. Each procedure has a Maximum Scale Change Limit that was programmed when the procedure was developed. The program will not let you exceed that Scale Limit while in the 'Production Mode'.

At the Weld screen, pressing the [CLEAR] key will zero all the Scale factors applied to the procedure, so the procedure runs as programmed.

## 5. Print Menu Operations

To access the printing function of the ACL Orbital Tube Welding System, be certain to have the factory supplied USB printer connected to the ACL, and from the MAIN SCREEN, select File/Print and desired printout (See Section G, pages 39 and 48).

Those options which are grayed out are not yet active until the information becomes available.

Select File/Print Setup...to change any of the printing parameters to customize your print out to your liking.

To accomplish this on the HHC, press the [PRINT MENU] button on the HHC or the "P" on the keyboard for the PRINT MENU on the HHC screen.

In order to utilize any one of the options shown on this menu, use either the HHC number buttons or the number keys on the keyboard. If certain steps are not taken prior to reaching this screen, some of the eight may not yet be active. This will be discussed in the following:

**5.1 Option [1 Procedure + (Weld) Data]** will print out the weld procedure with full heading, which currently loaded and active. The name of this procedure will appear after the word "Procedure" in the title of this option.

The full heading is useful for documenting production welds and can be utilized as a quality control document. The information contained as part of the form above the parameters of the weld procedure listing contains most of the data necessary to properly track and document a weld for future analysis, job costing, and quality assessment.

**5.2 Option [2 Procedure]** provides the same stored weld procedure parameter data as the first option, [1 Procedure & Weld Data], but does not include the printing which provides operator input for weld information. The name of this procedure will appear after the word "Procedure" in the title of this option.

This printout is useful for situations that are not linked to production welding where quality control is accountable. This would include situations where a quick printout is necessary to inspect the weld procedure parameters verification prior to performing a series of welds. Another application may be during weld procedure development or modification.

**5.3 Option [3 Headings(: Full / Brief)]** is used as a toggle between two different types of heading on each printout: Full or Brief. Choosing this option will toggle the "Brief heading" check mark in File/Print Setup... dialog accessible on the MAIN SCREEN where there are many more customization options.

The Full heading provides information such as the ACL's identity: name, model number and serial number. This is especially useful in multi-machine job situations where it is important to track the welds not only by part serial number but also by which machine has performed the weld.

The Brief heading shows only the title of the printout without any of the ACL identification. This print out heading is useful for situation

where the ACL information is not necessary such as in weld procedure development.

**5.4 Option [4 List (of Saved Procedures)]** provides a directory of the saved weld procedures residing on the memory of the ACL. This provides a quick reference to the user for finding an applicable weld procedure without having to load and view each procedure, or having to print out each individual procedure.

The first column is the procedure name. A procedure with a “/#” after it indicates a revision. The revisions will show as “/A”, “/B”, and so on.

The second column consists of the four identification lines appearing at the beginning of the procedure Weld Record (see Modifying Weld Procedures, Section 2.9).

The third column shows the last date and time the weld procedure was modified and saved.

**5.5 Option [5 Calib(rate Data)]** provides the Motor Calibration results of the latest calibration sequence.

This result is either from initial Motor Calibration at ACL startup or from the MAIN SCREEN, Calibrate/Motor... menu or click on [Motor Calibrate] icon on the toolbar or press [Main Menu] and [8 Calibrate] on the HHC or by modifying the weld procedure to perform a home pre-weld calibration update prior to each weld.

This printout gives all pertinent data of the last Motor Calibration, Motor and Tachometer Gain Errors, as well as the last date and time of the Motor Calibration.

**5.6 Option [6 Scaled (Procedure Print Enabled)]** provides a printout of the weld procedure with updated scaled parameters for both the Current and Motor.

Choosing this option will toggle the “Print scaled values” check mark in File/Print Setup... dialog on the MAIN SCREEN. This will convert the scaled parameters to their scaled values without changing the original values in memory. This can be accomplished even without performing a weld, either in WELD or TEST Mode.

While at the Weld Screen, adjust either the Current or Motor by scaling either up or down. Press [PRINT MENU] on the HHC, select this option to “Enable”, and then select Option [2]. This will give a printout of the scaled parameters, while maintaining the integrity of the original parameters.

This is useful when needing to see how apparent scale changes will affect either current or motor speed without actually doing it.

**5.7 Option [7 (Strip) Chart]** will print out the resultant strip chart from the last weld.

Whether in TEST or WELD Mode this function will printout the entire length of the printout from the screen. With every length of strip chart on the screen being equal to eight seconds of the weld procedure, a large diameter weld could easily use five screens or more. Printouts in this option will give one sheet of tractor paper for every screen of weld from the procedure.

This option is quite useful when tracking individual welds, as their pulsing values for current and voltage are kept on hard copy. For production purposes, especially on larger diameter welds, individual printouts from this option would not be recommended since the speed of the printer is limited.

**5.8 Option [8 Deviations]** provides a printout of all weld procedure deviation that occurred during the weld.

Whether Data Monitor values are used or not, a deviation is also registered as the pressing of a button on the HHC or on the weldhead handle. Once the weld is finished, given there are no deviations, a screen will appear showing that there were no deviations during the procedure.

When a deviation is registered it will show exactly when it occurred: in which Level, what time in the Level, what degree of rotation the deviation occurred at, and the type of deviation.

This printout can be beneficial when a hard copy of all deviations is needed for weld tracking and evaluation of integrity.

## **6. Log Menu Operations**

**6.1 “Show Last Log”** will show a MAIN SCREEN the log display from the last actual weld.

From the MAIN SCREEN, select Log/Show Last Log.  
This function is not available on HHC.

**6.2 “Print Strip Chart”** will print out the resultant strip chart of the actual weld.

From the MAIN SCREEN, select Log/Print Strip Chart.

To accomplish this on the HHC, press the [PRINT MENU] button on the HHC or the “P” on the keyboard for the PRINT MENU on the HHC screen followed by option [1 Print Strip Chart].

Whether in TEST or WELD Mode this function will printout the entire length of the printout from the screen. With every length of strip chart on the screen being equal to eight seconds of the weld procedure, a large diameter weld could easily use five screens or more.

This option is quite useful when tracking individual welds, as their pulsing values for current and voltage are kept on hard copy. For production purposes, especially on larger diameter welds, individual printouts from this option would not be recommended since the speed of the printer is limited.

**6.3 “Print Deviations/Log”** provides a printout of all weld procedure deviation that occurred during the weld.

From the MAIN SCREEN, select Log/Print Log.

To accomplish this on the HHC, press the [PRINT MENU] button on the HHC or the “P” on the keyboard for the PRINT MENU on the HHC screen followed by option [2 Print Deviations].

Whether Data Monitor values are used or not, a deviation is also registered as the pressing of a button on the HHC or on the weldhead handle. Once the weld is finished, given there are no deviations, a screen will appear showing that there were no deviations during the procedure.

When a deviation is registered it will show exactly when it occurred: in which Level, what time in the Level, what degree of rotation the deviation occurred at, and the type of deviation.

This can be beneficial when a hard copy of all deviations is needed for weld tracking and evaluation of integrity.

**6.4 “Delete Log”** allows the operator to erase any saved logs, which are on the floppy diskette or USB or Ethernet storage.

From the MAIN SCREEN, select Log/Delete...

To accomplish this on the HHC, press the [PRINT MENU] button on the HHC or the "P" on the keyboard for the PRINT MENU on the HHC screen followed by option [0 Erase Log on Disk].

When selected, the library of logs that are on the diskette will appear; this will appear similar to the procedure library.

Use the cursor keys to select the log to be erased.

Pressing [ENTER] will ask you to accept erasing of the selected log.

Press "Y" or [YES] to erase. Press "N" on the keyboard, or [NO] on the HHC to keep.

**6.5 "Save Log"** allows the operator to save the current weld log to a floppy diskette or USB or Ethernet storage.

From the MAIN SCREEN, select Log/Save As...

To accomplish this on the HHC, press the [PRINT MENU] button on the HHC or the "P" on the keyboard for the PRINT MENU on the HHC screen followed by option [T Copy Log to Disk].

The saved weld log can now be utilized on any PC that has Microsoft Excel® loaded. In this program, the results from the weld log (deviations, amps, volts and motor speed) can be examined and plotted to resemble the Strip Chart printout.

This is especially useful when either of the save options are not enabled, but the operator needs to save a particular log.

When doing so, the Short Log File function still applies. Meaning if Short Log File is enabled, then when the log is saved, only the procedure parameter information will copy and not the weld performance data.

## Section C

### Accessories

#### Alternative or Additional Input Power Cords:

843-0600 120 VAC, Single Phase

843-0602 208 - 240 VAC, Single Phase

843-0603 208 - 240 VAC, Three Phase

843-0601 220 VAC, Single Phase, Euro

843-0613 Universal 120 VAC, 30 A UL

843-0714 220 VAC Single Phase, CCC version

#### Step Down Transformer:

001-1230 480/240VAC, 3 Phase, Stand Alone Transformer

#### ACL Tools and Accessories:

005-0698 Calibration Kit

#### Recirculators

250-153 CobraCooler Coolant Recirculator

## Section D

## Maintenance

### Setting Time & Date

To change the Time & Date, which shows on the top of the screen, as well as on all printouts and saved Weld Logs, use option [0 Time & Date].

When this option is selected all the essential settings appear as defined in the File/Preferences.../Advanced menu:

The cursor box can be moved from one set of settings to the next, either by using the cursor keys or, pressing [ENTER] to accept the settings highlighted.

To change the settings, move the cursor box to the settings to be changed and type in the changes.

Once the last set of changes is accepted, the date and time at the top of the screen instantly change to reflect the modifications made.

### Calibration/Verification Procedure

The ACL Calibration Software provides the user a means of calibration the ACL welder parameters: Current (AMPS), Arc Voltage (VOLTS) and Rotor Speed (RPM).

In the ACL welder MAIN SCREEN, menu selection [9 Calibrate Analog Input/Output] will setup a built-in Weld Calibration Procedure **ANA\_CAL**. This procedure is part of the ACL program... it **CANNOT** be edited, modified and/or erased. This procedure consists of 13 levels, each of which increases in both AMP and RPM values: from 5.0 to 200.0 Amps and from 1.00 to 10.00 RPM.

Each level in this procedure is 300.0 seconds (5 minutes) long. This enables the Calibration Technician more than enough time to measure, evaluate and adjust ACTUAL and FEEDBACK AMP values and ACTUAL and FEEDBACK RPM values.

The [NEXT LEVEL/GAS] button in orange, if pressed during the welding or testing of the welding program, will jump from its present level to the next level. Subsequent pressing of this button will continue to jump to subsequent levels of the program. While changing from one level to the next, both the AMP and RPM values increase to the value of that level.

Once the last level has been reached, if the [NEXT LEVEL/GAS] button is pressed, the program will start over again at Level 1. This will cause the program to Loop through procedure **ANA\_CAL** again.

By using this procedure and the setups in the following sections, the user will step through the **ANA\_CAL** weld procedure and adjust the weld parameters at each level of the procedure by pressing the indicated keys of the HHC. All final data can be recorded neatly and completely on the calibration data form provided.

#### **CAUTION**

*Before beginning final calibration **VERIFY THAT ALL TEST EQUIPMENT USED FOR MEASURING HAS A CURRENT UNBROKEN CALIBRATION SEAL.***

*Use of uncalibrated test equipment will invalidate the calibration you are about to perform.*

### Required Test Equipment

- 4 1/2 Digit DMM, with varied leads.
- 20VDC adjustable power supply, with varied leads.
- Calibration Kit (P/N 005-0251)

## Calibration Kit

In order for the calibration procedure to be successfully performed, the Calibration Kit must first be connected and adjusted. The Calibration Kit consists of a general purpose air-cooled handheld TIG torch rated at 150 amps, a calibrated current shunt (50mV/200A) in a fixture with standard dual female banana plug connectors and leads, all of which are mounted within an adjustable fixture for calibration purposes.

Adjustment of the Calibration Kit requires the use of standard feeler gauges and an adjustable end wrench. Turn the copper block counter-clockwise so that it is approximately 1/4" from the bottom of the torch cup (nozzle), spin the hex-nut up to and against the bottom of the block. Holding the nut with the wrench, turn the copper block clockwise and down against the nut, thus in effect "jamming" the block and nut against each other.

### *NOTE*

*Positive and tight surface contact between the copper block and the "jam" nut on the stud is absolutely essential in order to maintain a consistent and stable arc.*

Once the block is secured against the nut, remove the black cap from the top of the torch. Place a feeler gauge (0.035" - 0.045") under the cup and drop the tungsten down through the collet in the torch (collet and collet body for holding 3/32" diameter tungsten are standard), so that it stops on the feeler gauge. Replace the cap onto the torch and tighten to hold the tungsten from moving.

If adjusted properly, this will assure a consistent tungsten-arc-gap for performing the Current Calibration portion of this procedure.

## Arc Voltage Calibration

The weldhead control connector on the weldhead cable should be plugged into the ACL. Be certain there is no obstruction in the weldhead - **the rotor must turn for this test to work.**

Connect the DC power supply to the ARC VOLTAGE side of the shunt box, positive-to-positive, and negative-to-negative. Then connect the DMM either at the power supply or across the power supply leads at the shunt box, and set the DMM to read up to 20 VDC.

If the leads in this operation are reversed, the arrows on the Voltage bar graph will point in the reverse direction and the power supply may "fold back" on itself.

This will cause the voltage from the power supply to drop and the current will peak to maximum. When this occurs, turn the power supply and the ACL off, check polarity connection from the power supply to the shunt box, and restart this calibration.

A negative reading on the DMM means the leads between the DMM and the shunt box or power supply are reversed. To correct this simply reverse the reading leads either at the DMM or at the shunt box.

Once connected, with the ACL in TEST Mode, press [START/STOP] on the HHC. The **ANA\_CAL** procedure will enter Level 1 and the rotor will start rotating.

Input each of the Voltage levels that are listed on the attached calibration data sheet. At each input voltage, if needed, adjust the displayed FEEDBACK VOLTS (to the right of the Voltage Bar Graph on the bottom of the monitor screen) by pressing the PAGE UP or PAGE DOWN buttons on the HHC, until the values equals that which is shown on the DMM. Each button press is equal to 1/100 V scale adjustment.

Record each of the final display values on the data sheet.

Press [START/STOP] on the HHC when complete. Repeat if necessary.  
Verify that each of the recorded values equal = Input Voltage  $\pm$  0.2VDC.

### **Rotor Speed Calibration**

The weldhead control connector on the weldhead cable should be plugged into the ACL. Be certain there is no obstruction in the weldhead - **the rotor must turn for this test to work.**

Once connected, with the ACL in TEST Mode, press [START/STOP] on the HHC. The **ANA\_CAL** procedure will enter Level 1 and the rotor will start rotating.

Press [NEXT LEVEL/GAS] on the HHC to jump to the next level, thus changing the rotor speed to the next RPM value. This will occur whenever the [NEXT LEVEL/GAS] button is pressed.

At each DEMAND RPM (which is that RPM value in the **ANA\_CAL** procedure), adjust the ACTUAL RPM of the weldhead rotor (displayed to the right and below of the RPM Bar Graph at the bottom of the monitor screen) by pressing the RIGHT ARROW or LEFT ARROW on the HHC, until the ACTUAL RPM equals that of the DEMAND RPM. Each button press is equal to 1/200 RPM output adjustment.

Once an adjustment is made to the ACTUAL RPM, wait until the rotor makes two complete revolutions before making secondary adjustments to the ACTUAL RPM. The ACTUAL RPM is updated after the second rotor revolution and every subsequent revolution past the "Home" position.

Once the ACTUAL RPM value is set equal to the DEMAND RPM value, the FEEDBACK RPM (displayed just to the right of the RPM Bar Graph at the bottom of the monitor screen) must be adjusted to equal that of the ACTUAL RPM value. Pressing the % MOTOR SCALE UP or % MOTOR SCALE DOWN on the HHC accomplishes this. Each button press is equal to 1/200 RPM feedback adjustment.

Record each of the final display values on the data sheet.

Verify that each of the recorded values = (DEMAND RPM  $\pm$  0.5 RPM) or (DEMAND RPM  $\pm$  1%), whichever is greater.

Press [START/STOP] on the HHC when complete. Repeat if necessary.

### **Current Calibration**

From the Calibration Kit to the ACL; connect the torch lead to the BLACK connector, the ground lead to the GREEN connector and the torch purge gas connector to the ARC GAS port on the rear panel of the ACL. The weldhead control connector on the weldhead cable should be plugged into the ACL. Be certain there is no obstruction in the weldhead - **the rotor must turn for this test to work.**

Connect the DMM to the CURRENT SHUNT side of the shunt box, positive-to-positive and negative-to-negative. Set the DMM to read up to 50 mVDC.

If the leads between the DMM and the shunt are reversed, the readout on the DMM will show negative mV values. To correct this; simply reverse the leads either at the DMM or at the shunt.

### **CAUTION**

*REMOVE ALL TEST EQUIPMENT FROM THE  
ARC VOLTAGE SIDE OF THE SHUNT BOX PRIOR  
TO STARTING THE CURRENT CALIBRATION.*

Once connected, with the ACL in WELD Mode, press [START/STOP] on the HHC. The **ANA\_CAL** procedure will initiate and establish an arc within the tungsten arc gap, then enter Level 1 and the rotor will start rotating.

**CAUTION**

***PROLONGED EXPOSURE TO THE WELDING ARC  
MAY RESULT IN INJURY TO THE EYES AND/OR SKIN.  
PROTECT ALL PERSONNEL FROM ALL ARC FLASHES.***

*Unnecessary extended time in each level of calibration,  
or performing repeated calibrations will cause all fixturing  
(torch, block and cables) to become very hot.*

***EXPOSURE TO THESE VERY HOT ITEMS  
WILL RESULT IN INJURY TO THE SKIN.  
USE CAUTION WHEN HANDLING VERY HOT FIXTURING.***

Press [NEXT LEVEL/GAS] on the HHC to jump to the next level, thus changing the current to the next AMP value. This will occur whenever the [NEXT LEVEL/GAS] button is pressed.

At each DEMAND AMPS (which is that AMPS value in the **ANA\_CAL** procedure), adjust the ACTUAL AMPS of the welding arc (displayed on the DMM (mV x 4 = ACTUAL AMPS)) by pressing the UP ARROW or DOWN ARROW on the HHC, until the ACTUAL AMPS equals that of the DEMAND AMPS. Each button press is equal to 1/10 A output adjustment.

Once the ACTUAL AMPS are set equal to the DEMAND AMPS, the FEEDBACK AMPS (displayed just to the right of the AMPS Bar Graph at the bottom of the monitor screen) must be adjusted to equal that of the ACTUAL AMPS value. Pressing the % CURRENT SCALE UP or % CURRENT SCALE DOWN on the HHC accomplishes this. Each button press is equal to 1/10 A feedback adjustment.

**NOTE**

*Once all the necessary measurements and assessments  
have been made for each level, it is **HIGHLY ADVISABLE**  
to change levels and not remain in any one level  
for the entire 300.0 seconds.*

Record each of the final display values on the data sheet.

Verify that each of the recorded values = DEMAND AMPS ± 2.0 Amps.

Press [START/STOP] on the HHC when complete. Repeat if necessary (read CAUTION statement for Current Calibration).

**NOTE**

*For unusual readings on charts and bar graphs read below for possible explanation:*

The "Fit" function for the Charts and Bar graphs, operates by finding minimum and maximum values of the charts displayed and scales the charts' ranges to fit the charts for the best view. However, these ranges may not be correct for the next weld or when "Fit" function is used without any data, causing maximum zoom to be used. This in turn, may cause a normal (small) signal noise to appear and be interpreted as a large signal when in fact it should be ignored.

Therefore, it is recommended to use "Max" or "User" settings before any weld and only use "Fit" afterwards (if needed) and always check Charts' ranges.

This will prevent any confusion and incorrect interpretation of the Charts and Bar graphs.

## ACL CALIBRATION DATA SHEET

UNIT S/N \_\_\_\_\_ WELDHEAD S/N \_\_\_\_\_ SOFTWARE REV. \_\_\_\_\_

### CURRENT CALIBRATION

#	Actual AMPS (mV x 4)	Feedback AMPS (A)	Demand AMPS (A)	Actual AMPS (mV x 4)	Feedback AMPS (A)
10	_____	_____	_____	_____	100
20	_____	_____	_____	_____	120
40	_____	_____	_____	_____	150
60	_____	_____	_____	_____	180
80	_____	_____	_____	_____	200

### ARC VOLTAGE CALIBRATION

Input Voltage (V)	2	4	6	8	10	12	14	16	18	20
Feedback Volts (V)	—	—	—	—	—	—	—	—	—	—

### ROTOR SPEED CALIBRATION

Demand (RPM)	Actual (RPM)	Feedback (RPM)	Demand (RPM)	Actual (RPM)	Feedback (RPM)
0.5	_____	_____	6	_____	_____
1	_____	_____	7	_____	_____
2	_____	_____	8	_____	_____
3	_____	_____	9	_____	_____
4	_____	_____	10	_____	_____
5	_____	_____			

Technician \_\_\_\_\_

Date \_\_\_\_\_

## Section E Troubleshooting

### Fault Messages

<u>MESSAGE</u>	<u>DESCRIPTION</u>
* Printer Bad *	<p>ACL not reading printer.</p> <p><u>Probable Cause:</u> Printer not connected, not turned on, not on-line, or there is no paper loaded.</p> <p><u>Corrective Action:</u> Connect printer, turn printer on, load paper and press on-line button.</p>
* STATUS: Gas Fault *	<p>Arc Gas not flowing in Weld Mode.</p> <p><u>Probable Cause:</u> Gas cylinder empty or manifold turned off. Gas connections not secure. Knob on flow tube turned off.</p> <p><u>Corrective Action:</u> Check gas supply, connection and adjustments.</p>
* STATUS: Arc Fault *	<p>No arc established during High Voltage arc strike.</p> <p><u>Probable Cause:</u> Weldhead leads not connected. Arc strike current set too low. Poor quality or dirty tungsten electrode. Poor grounding of workpiece through collets and cartridge. Dirty or misaligned workpiece. Tungsten arc gap not properly set. Arc Gas flow set too low or poor quality.</p> <p><u>Corrective Action:</u> Check weldhead connections and grounding through collets and cartridge. Inspect, clean and refurbish tungsten electrode geometry. Replace with better quality tungsten electrode. Clean and re-align workpiece, adjust tungsten arc gap and Arc Gas flow.</p>
* STATUS: Motor Stall *	<p>ACL indicates weldhead rotor is not turning.</p> <p><u>Probable Cause:</u> Weldhead Amphenol not properly connected. Tungsten welded to workpiece, keeping rotor from turning. Foreign substance jammed in weldhead gears. Coupler shaft and/or shear pin(s) damaged. Motor/Tach mechanism not functioning.</p> <p><u>Corrective Action:</u> Reconnect weldhead Amphenol. Dismantle, inspect and clean weldhead, gears, rotor and Motor/Tach mechanism. Replace failed components.</p>
* Disk: Timeout *	<p>Error reading disk.</p> <p><u>Probable Cause:</u> No diskette in drive or bad diskette.</p> <p><u>Corrective Action:</u> Insert diskette prior to performing disk drive function. Use formatted diskette.</p>
* DISK: WritePrct *	<p>Error writing to disk.</p> <p><u>Probable Cause:</u> Write Protect tab on diskette is set to protect (Read Only).</p> <p><u>Corrective Action:</u> Move Write Protect tab on diskette to Write Mode.</p>
* DISK: No File *	<p>Drive not finding proper files on diskette.</p> <p><u>Probable Cause:</u> Targeted files cannot be found on diskette.</p> <p><u>Corrective Action:</u> Locate files prior to erasing from or copying from diskette.</p>
* DISK: No Disk *	<p>Not reading diskette in drive.</p> <p><u>Probable Cause:</u> No diskette in drive when saving to or erasing from diskette.</p> <p><u>Corrective Action:</u> Insert diskette in drive prior to performing disk functions.</p>
* DISK: WrongDisk *	<p>Using wrong size disk in drive.</p> <p><u>Probable Cause:</u> Diskette in drive not formatted to 1.44 Mb.</p> <p><u>Corrective Action:</u> Remove diskette from drive and use only formatted 1.44 Mb sized diskette.</p>

## Section E Troubleshooting

### (Continued) Fault Messages

#### MESSAGE

#### DESCRIPTION

*Battery Low*	Voltage not within specification. <u>Probable Cause:</u> Battery voltage on Memory Board (P/N 003-1806) under 2VDC, minimum. <u>Corrective Action:</u> Check battery voltage and replace if below specification.
No power to system when switched to "ON"	<u>Probable Cause:</u> Power cables not probably connected. No line voltage at power outlet. Main breaker and electrical panel tripped. <u>Corrective Action:</u> Check main breaker at electrical panel. Check voltage at outlet. Reconnect power cable plugs at both outlet and ACL.
No power to monitor.	No information on screen. <u>Probable Cause:</u> Monitor not turned on. Power/interface cables not properly connected. <u>Corrective Action:</u> Turn monitor switch "ON". Inspect and reconnect power/interface connections at monitor and ACL.
* Hand Held Bad *	No communication with HHC. <u>Probable Cause:</u> Poor connection at ACL or HHC. Damaged HHC or cable. <u>Corrective Action:</u> Reconnect cable at ACL and HHC. Inspect and replace faulty components.
Rotor does not home.	When rotor is commanded to return home, it does not stop and continues to spin. <u>Probable Cause:</u> Faulty or mis-aligned reed switch in weldhead. Poor wiring connections in weldhead handle. <u>Corrective Action:</u> Inspect and re-align reed switch. Reconnect wiring harness in weldhead handle. Replace faulty connectors and/or reed switch.
**Cal: TIME ** ** DO NOT WELD **	Weldhead can not be calibrated. <u>Probable Cause:</u> Weldhead Amphenol not properly connected. Rotor and/or gears jammed. Motor/Tach mechanism not functioning. <u>Corrective Action:</u> Reconnect weldhead Amphenol. Inspect and clear jammed rotor and/or gears and Motor/Tach mechanism. Replace failed components.
* FAULT: WPS Hot *	Interface between computer and weld power supply faulty. Opened thermal inside weld power supply. <u>Probable Cause:</u> Power supply is hot. Faulty interface boards and/or ribbon cable connections. Loose ribbon cable connections. <u>Corrective Action:</u> Turn ACL off, let power supply cool and try again later. Analyze components using ACL Diagnostic Test Kit (P/N 005-0347). Inspect and replace faulty interface boards, components and/or ribbon cables.
* DISCR I/O Bad *	Digital interface between computer and weld power supply faulty. <u>Probable Cause:</u> Analog self calibration failed. Faulty interface boards and/or ribbon cable connections. Loose ribbon cable connections. <u>Corrective Action:</u> Analyze components using ACL Diagnostic Test Kit (P/N 005-0347). Inspect and reconnect ribbon cable connection. Inspect and replace faulty interface boards, components and/or ribbon cables.
* ADC Cal Error *	Analog interface between computer and weld power supply faulty. <u>Probable Cause:</u> Analog self-calibration failed. Faulty interface boards and/or ribbon cable connections. Loose ribbon cable connections. <u>Corrective Action:</u> Analyze components using ACL Diagnostic Test Kit (P/N 005-0347). Inspect and reconnect ribbon cable connection. Inspect and replace faulty interface boards, components and/or ribbon cables.

**Section E Troubleshooting**  
**(Continued) Fault Messages**

<b>MESSAGE</b>	<b>DESCRIPTION</b>
+5V Fault **	<p>Voltage not within specification or faulty. Interface between computer and weld power supply faulty.</p> <p><u>Probable Cause:</u> Faulty power supply or interface. Loose ribbon cable connections.</p> <p><u>Corrective Action:</u> Analyze components using ACL Diagnostic Test Kit (P/N 005-0347). Inspect and reconnect ribbon cable connection. Inspect and replace faulty interface boards, components and/or ribbon cables.</p>
** +24V Fault **	<p>Voltage not within specification or faulty. Interface between computer and weld power supply faulty.</p> <p><u>Probable Cause:</u> Faulty power supply or interface. Loose ribbon cable connections.</p> <p><u>Corrective Action:</u> Analyze components using ACL Diagnostic Test Kit (P/N 005-0347). Inspect and reconnect ribbon cable connection. Inspect and replace faulty interface boards, components and/or ribbon cables.</p>
** +15V Fault **	<p>Voltage not within specification or faulty. Interface between computer and weld power supply faulty.</p> <p><u>Probable Cause:</u> Faulty power supply or interface. Loose ribbon cable connections.</p> <p><u>Corrective Action:</u> Analyze components using ACL Diagnostic Test Kit (P/N 005-0347). Inspect and reconnect ribbon cable connection. Inspect and replace faulty interface boards, components and/or ribbon cables.</p>
** -15V Fault **	<p>Voltage not within specification or faulty. Interface between computer and weld power supply faulty.</p> <p><u>Probable Cause:</u> Faulty power supply or interface. Loose ribbon cable connections.</p> <p><u>Corrective Action:</u> Analyze components using ACL Diagnostic Test Kit (P/N 005-0347). Inspect and reconnect ribbon cable connection. Inspect and replace faulty interface boards, components and/or ribbon cables.</p>
** DAC Cal Error **	<p>Analog loop test failed. Interface between computer and weld power supply faulty.</p> <p><u>Probable Cause:</u> See ADC Cal Error. Loose ribbon cable connections.</p> <p><u>Corrective Action:</u> Analyze components using ACL Diagnostic Test Kit (P/N 005-0347). Inspect and reconnect ribbon cable connection. Inspect and replace faulty interface boards, components and/or ribbon cables.</p>
** FATAL FAULT **	<p>One or more of the previous FAULTS has occurred to prevent reliable system operation.</p> <p><u>Probable Cause:</u> Previously displayed FAULT.</p> <p><u>Corrective Action:</u> DO NOT WELD. Eliminate cause of previously displayed FAULT. Analyze components using ACL Diagnostic Test Kit (P/N 005-0347). Inspect and reconnect ribbon cable connections. Inspect and replace faulty interface boards, components and/or ribbon cables.</p>

## Section F

## Diagrams/Parts Lists

### List of Schematics

Please contact MK Products at 16882 Armstrong Ave. Irvine, CA (949) 863-1234 for a copy of the following schematics:

071-0300 003-1421, WPS Driver Card

071-0301 003-1420, WPS Servo Card

071-0304 003-1892, Base Drive Supply

071-0341 003-1838, Power Supply Triple Output

071-0344 003-1871, Motor Controller

071-0345 003-1872, System Interface

071-0346 003-1873, Mother Controller

	<u>U.S. Version</u>	<u>CCC Version</u>	<u>Description</u>
071-0406	003-2174	003-2517	TIG ARC PS
071-0408	003-1828	003-2522	WPS
071-0409	003-1828	003-2522	WPS

## Section G

### Quick Start Guide

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## Graphical Interface Navigation

You can use the mouse to adjust settings on some of the graphical interface windows (see below). You can also use the mouse on the toolbar and the drop down menu to access other functions of the program (see pg 2).

The drop down menu can also be accessed with keyboard strokes, which are covered in the help section of the menu (pg 2), as well as the ACL owner's manual (091-0568).

### Status Window:

Shows tube with current tungsten position marker and tick marks to depict levels. The blue pie slice shows the next level to be welded and the green pie slice represents completed levels.

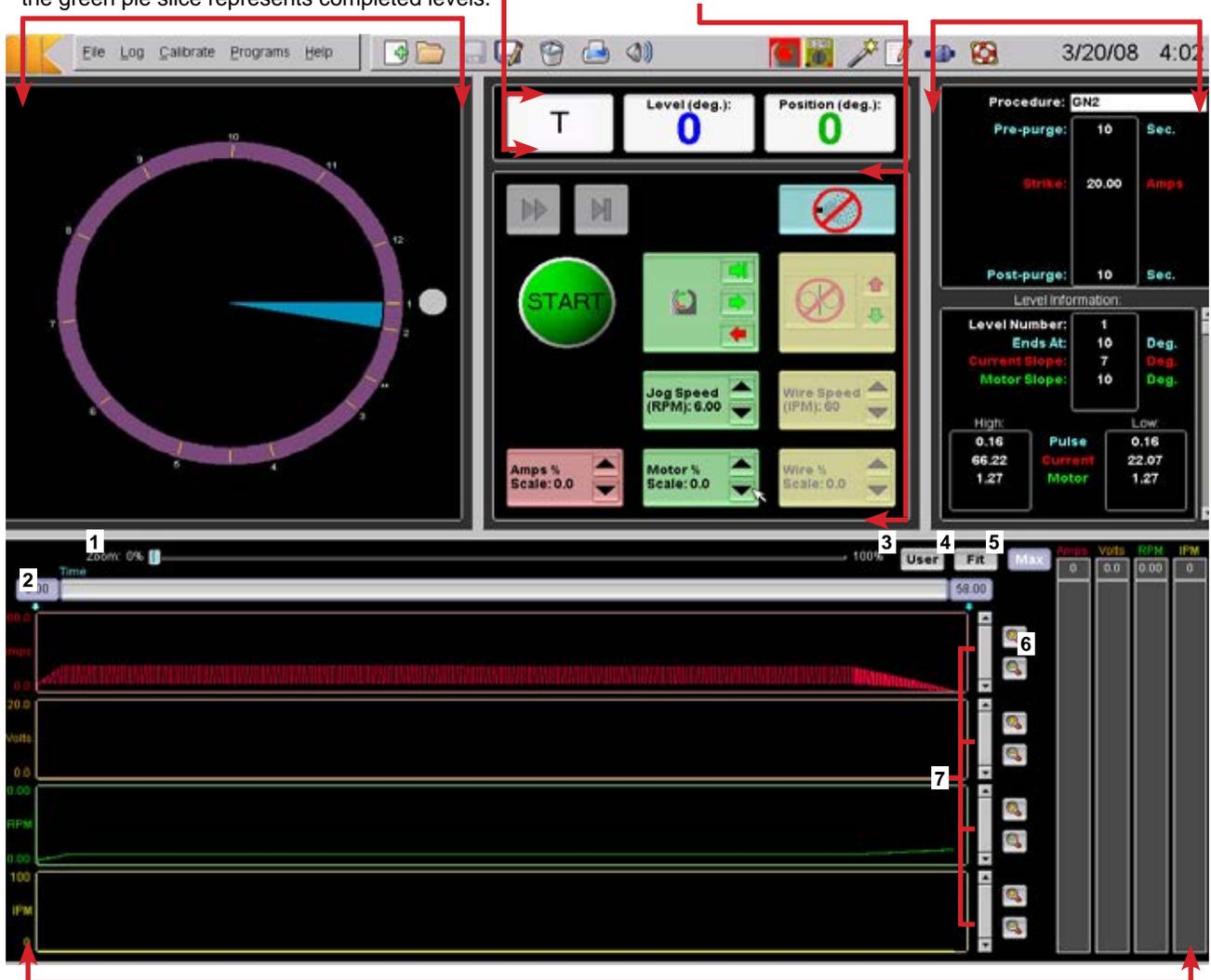
**Status Window:** Numeric representation of the current status, level information and tungsten location.

### ACL Control Window:

Contains all buttons and keys needed to perform weld-related tasks (see page 10).

### Weld Procedure Window:

Shows some of the weld procedure parameters. Use the slider to scroll through procedure levels (when not welding).



### Strip Chart and Bar Graph Windows:

Shows last weld's chart for post weld analysis and real time analog channel readings using bar graphs.

1. Top slider adjusts zoom amount in horizontal (time) axis.
2. Time slider shows size and location of the view in relation to the total weld time and can be moved to display each section of the chart.
3. User button sets chart and bar graph sizes to values defined in chart preferences and bar graph preferences.
4. Fit button sets chart and bar graph sizes to maximum values calculated or expected from weld data.
5. Max button sets chart and bar graph sizes to maximum values allowed.
6. Magnifying glass buttons expand or compress vertical chart axis.
7. Sliders move the chart vertically.

## Menu Commands and Toolbar Icons

Located at the top the graphical interface, the drop down menu and toolbar icons are two ways of performing non-weld related ACL functions. For more details about the functions of these commands, or to access these functions with keyboard strokes or the HHC, please consult the ACL owner's manual (P/N 091-0568).

The screenshot displays the software's menu bar and toolbar. The menu bar includes File, Log, Calibrate, Programs, and Help. The toolbar contains various icons for file operations, calibration, and system management. The date and time are shown as 7/09/07 4:00.

**Menu Bar:**

- File:**
  - New: APG ...
  - Open ...
  - Save
  - Save As ...
  - Delete ...
  - Print: Strip Chart, Log, Procedure, Procedure and Data, Procedure List, Motor Calibration, Ink Levels
  - Print Setup ...
  - Preferences ...
- Log:**
  - Show Last Log
  - Save As ...
  - Delete ...
  - Print Strip Chart
  - Print Log
- Calibrate:**
  - Motor ...
  - Analog I/O ...
- Programs:**
  - APG ...
  - MK Edit ...
  - Upgrade ...
  - Time/Date ...
- Help:**
  - Contents F1
  - About

**Toolbar:**

- Create Empty Deg Procedure
- Open Existing Procedure
- Save Modified Procedure
- Save Procedure With Different Name
- Delete Procedure
- Print Procedure/Data
- Enable/Disable Sound
- Open Calibrate Motor Dialog
- Open Calibrate Analog I/O Dialog
- Open APG Dialog
- Edit Weld Procedure
- Firmware Upgrade Dialog
- Help Contents
- Adjust Date and Time

## Motor Calibration



When the ACL completes its power up and the graphical interface is displayed, the motor calibration icon will flash in red (Figure 1). This is a reminder to calibrate your weldhead before proceeding with any welding.

Click the icon to bring up the motor calibration window and adjust to the preferred speed (Figure 2). Clicking on the Show Last button will bring up another window that displays the results of the previous motor calibration.

Motor Calibration  
Reminder



Figure 1

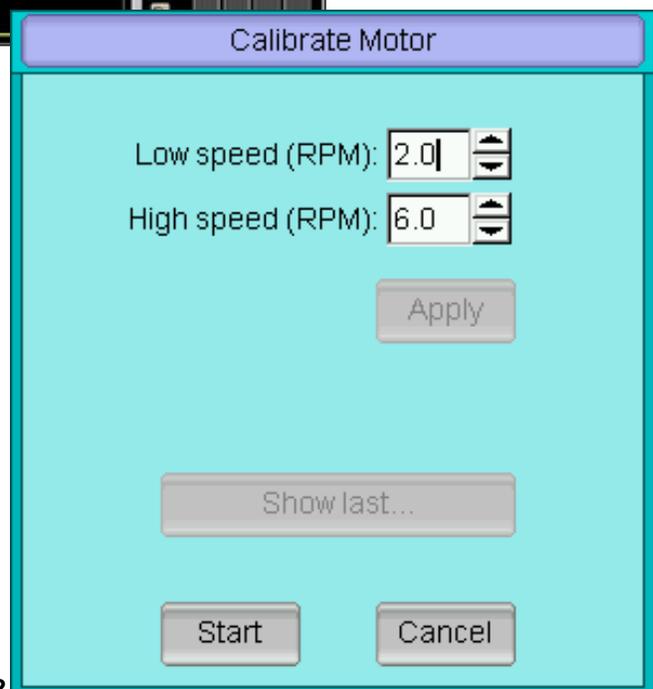


Figure 2

## Using Auto Procedure Generation



The Auto Procedure Generation (APG) icon opens the dialog and allows the operator to generate a weld procedure from settings entered in the APG window (Figure 3). Clicking the Advanced tab produces more options (Figure 4).

Once you have the desired settings in Step 1 and 2, click the Accept button. When the weld screen appears you can click the Start button to begin welding.

Figure 3

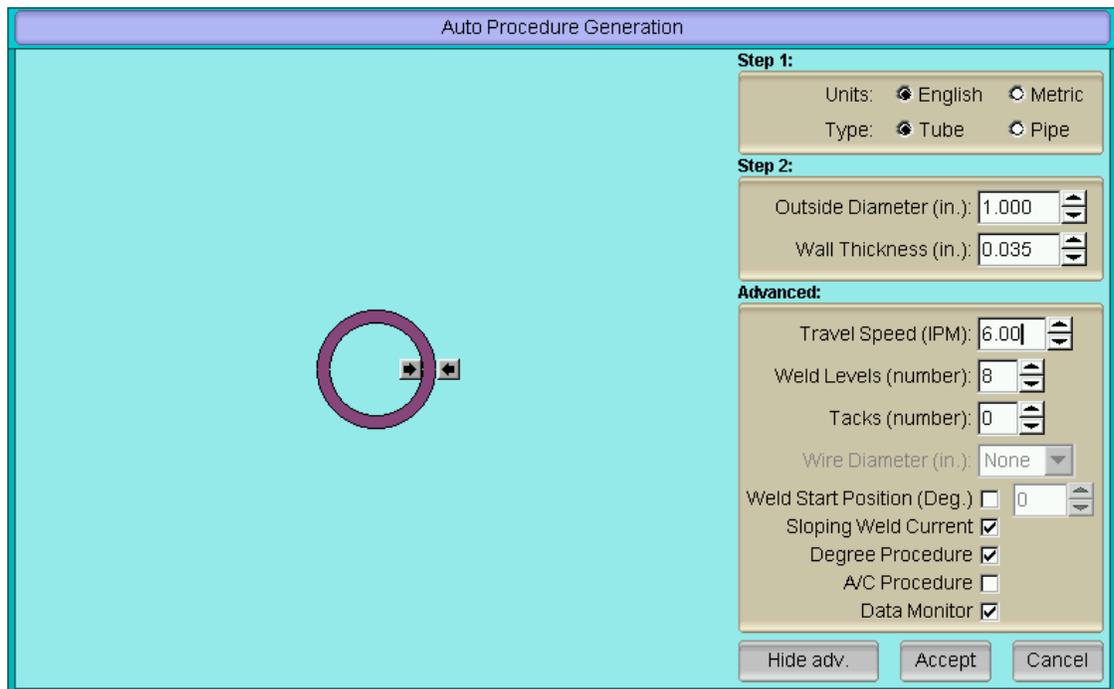
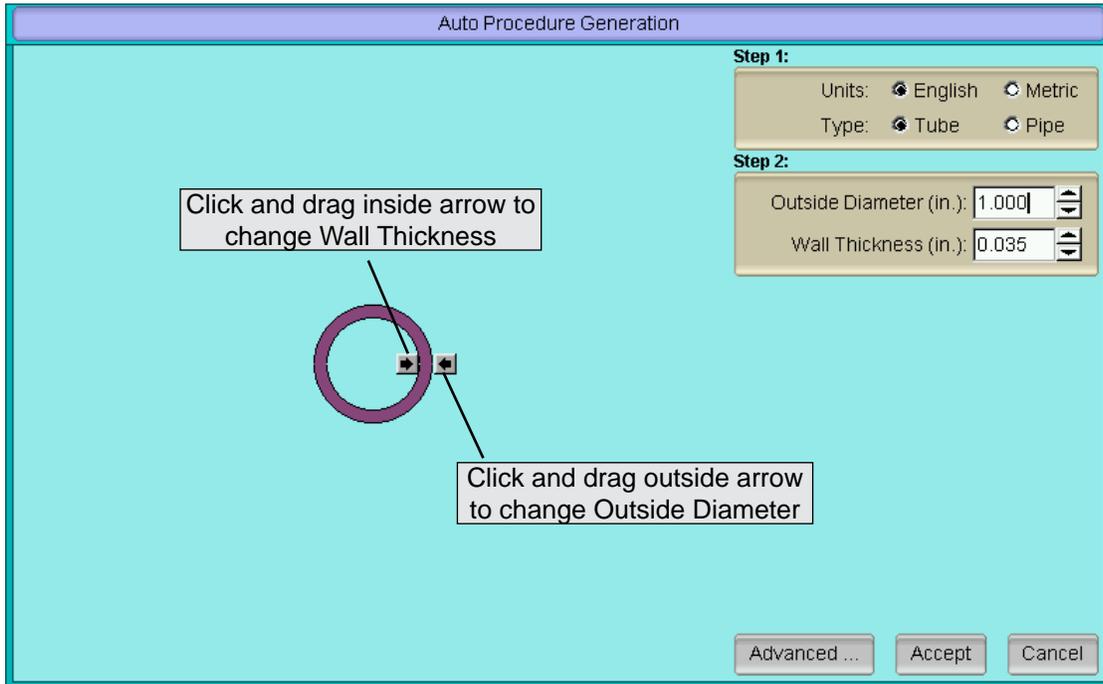


Figure 4

## Opening an Existing Procedure



If you have a saved weld procedure that you want to use, clicking the Open icon brings up a window with all saved weld procedures in the internal memory (Figure 5). Selecting a different location button will list the procedures stored there.

After selecting your procedure and clicking Open, the procedure's settings will be loaded into the ACL and can be viewed on the weld procedure window of the graphical interface (Figure 6). Modifications are made in MK Edit (see page 7).

To access the Ethernet location, make sure the settings are selected in the network tab of the preferences dialog (see pg 2 for its location in the drop down menu).

**Please Note: Most USB memory thumb drives will work; however, some occasionally will not be recognized and therefore may not work. If this occurs, try a different drive.**

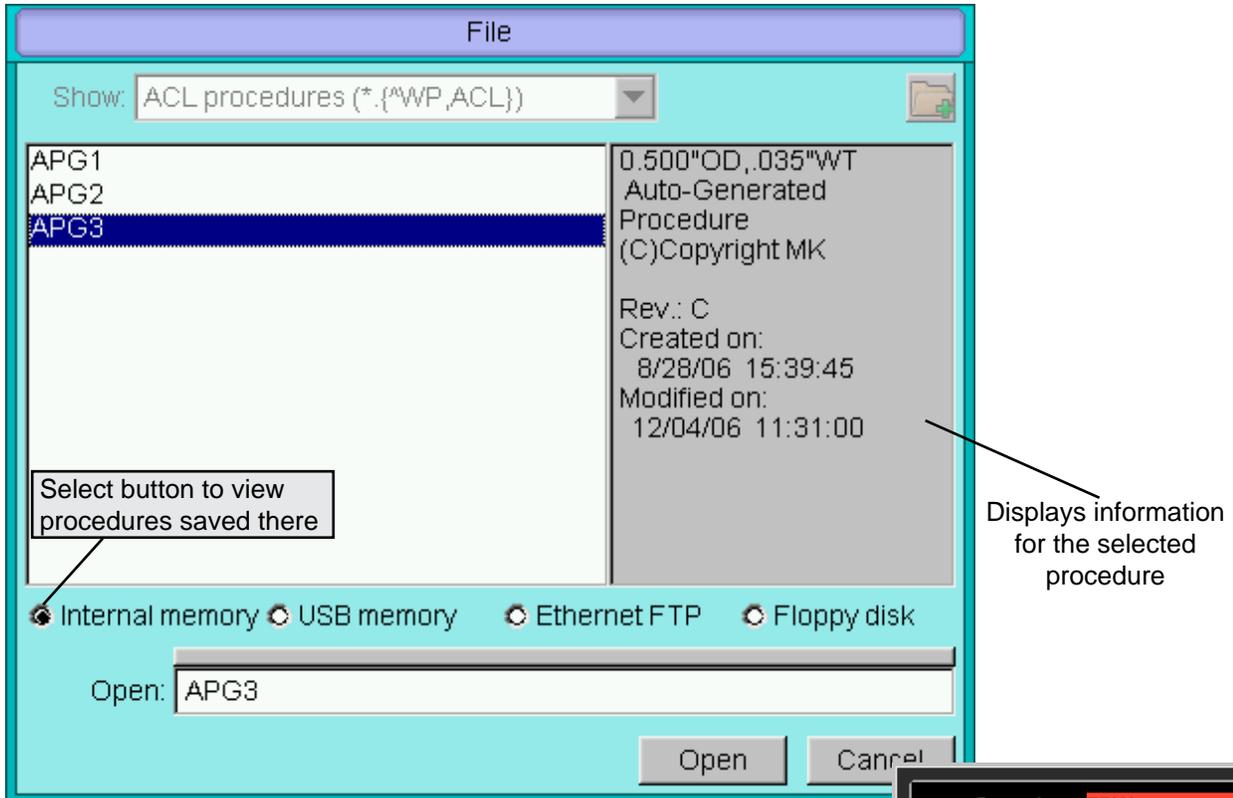


Figure 5



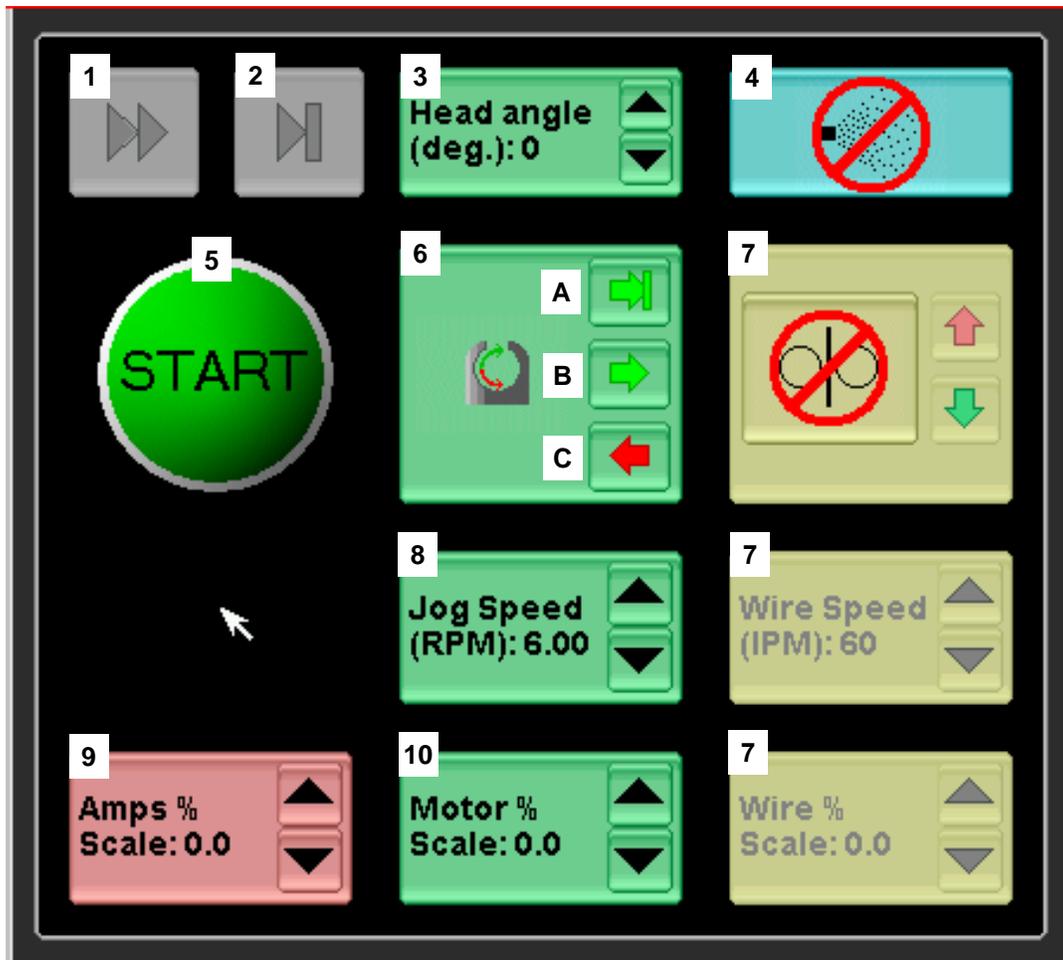
Figure 6

## Operating the ACL from the Graphical Interface



There are a number of actions you can make from the control window of the graphical interface (see below). This window contains buttons used to adjust weld-related tasks.

Most of the buttons have a shortcut key (a keyboard stroke or an HHC button) assigned to them. Refer to your owner's manual for a more in-depth description.



1. **Next Level** - Advances welding to the next level
2. **Final Slope** - Advances welding to final slope level
3. **Head Angle** - Specifies weldhead angle
4. **Gas** - Turns gas on or off. Icon shows when the gas is on or off. Since gas operation is automatic during welding, this button is only active when not welding.
5. **Start/Stop** - Begins or ends welding
6. **Motor** - Consists of three possible actions:
  - A. *Motor Home* - Starts motor homing
  - B. *Motor Jog Forward* - Jogs motor forward using job speed below as long as it is pressed.
  - C. *Motor Jog Reverse* - Jogs motor in reverse using jog speed below as long as it is pressed.
7. Not Yet Implemented
8. **Jog Speed** - Specifies jog speed to be used for motor jogging.
9. **Amps % Scale** - Specifies the amount of current adjustment needed when welding.
10. **Motor % Scale** - Specifies the amount of motor speed adjustment needed when welding.

## Modifying Procedures



If you decide to make changes to an existing procedure, clicking on the Weld Procedure icon will open up the window that allows for modifications.

Known as MK Edit, this window consists of three tabs, each allowing for the welder to input additional information. The first tab, Weld Record, allows modification of weld level parameters. After selecting a level (with the mouse or arrow keys), you can then click and drag the mouse within the tube to mark the level length and it will change the Ends At value for the selected level (Figure 7).

Clicking on any other parameter in the table also allows it to be changed (Figure 8).

You can also make changes to the ID strings, located at the top right of the window. Below these fields you can also adjust the max scale, pre and post purge seconds, strike current and number of tacks. For more information on the significance of these changes, please consult your owner's manual.

**Figure 7**

Procedure Edit

Weld Record | Weld Data | Advanced

MK Products, Inc. ACL(tm) Advanced Color Logic Procedure: TRIAL--

ID 1: 1.000"OD,.035"WT  
 ID 2: Auto-Generated  
 ID 3: Procedure  
 ID 4: (C)Copyright MK

Max Scale (%): 10  
 Pre-Purge (Sec): 10  
 Strike (Amps): 20  
 Tacks (Number): 0  
 Post-Purge (Sec): 10

Level		Level Slope		Pulse	
No.	Ends at Deg	Current Deg	Motor Deg	High Sec	Low Sec
1	10	7	10	0.08	0.00
2	61	51	51	0.08	0.00
3	112	51	51	0.08	0.00
4	164	52	52	0.08	0.00
5	218	54	54	0.08	0.00
6	267	52	52	0.08	0.00
7	318	51	51	0.08	0.00
8	20	62	62	0.08	0.00
				0.04	0.00

Accept

**Figure 8**

Procedure Edit

Weld Record | Weld Data | Advanced

MK Products, Inc. ACL(tm) Advanced Color Logic Procedure: TRIAL--

ID 1: 1.000"OD,.035"WT  
 ID 2: Auto-Generated  
 ID 3: Procedure  
 ID 4: (C)Copyright MK

Max Scale (%): 10  
 Pre-Purge (Sec): 10  
 Strike (Amps): 20  
 Tacks (Number): 0  
 Post-Purge (Sec): 10

Level		Level Slope		Pulse		Current		Motor		AC Welding	
No.	Ends at Deg	Current Deg	Motor Deg	High Sec	Low Sec	High Amp	Low Amp	High RPM	Low RPM	Str mSec	Rev mSec
1	10	7	10	0.08	0.08	32.52	10.82	1.91	1.91		
2	61	51	51	0.08	0.08	32.52	10.82	1.91	1.91		
3	112	51	51	0.08	0.08	31.60	10.53	1.91	1.91		
4	164	52	52	0.08	0.08	30.68	10.22	1.91	1.91		
5	215	51	51	0.08	0.08	29.75	9.90	1.91	1.91		
6	267	52	52	0.08	0.08	28.82	9.60	1.91	1.91		
7	318	51	51	0.08	0.08	27.90	9.30	1.91	1.91		
8	20	62	62	0.08	0.08	26.98	8.97	1.91	1.91		
**	90	70	70	0.04	0.04	0.00	0.00	2.87	2.87		

Accept Cancel

## Modifying Procedures, con't.



The second tab in MK Edit is Weld Data. It allows for more details about a procedure (see below). This extra information and comments are saved with the procedure but are only used for documenting and printing and are not necessary for welding.

Procedure Edit

Weld Record Weld Data Advanced

Weld Description: <input style="width: 90%;" type="text"/>	Date Welded: <input style="width: 90%;" type="text"/>
Project ID: <input style="width: 90%;" type="text"/>	Operator: <input style="width: 90%;" type="text"/>
Special Conditions: <input style="width: 90%;" type="text"/>	Date Accepted: <input style="width: 90%;" type="text"/>
	Accepted by: <input style="width: 90%;" type="text"/>

Electrode Side	Latch Side
Matl OD: <input style="width: 40%;" type="text"/> Wall Thk: <input style="width: 40%;" type="text"/>	Matl OD: <input style="width: 40%;" type="text"/> Wall Thk: <input style="width: 40%;" type="text"/>
Material Type: <input style="width: 40%;" type="text"/> Alloy: <input style="width: 40%;" type="text"/>	Material Type: <input style="width: 40%;" type="text"/> Alloy: <input style="width: 40%;" type="text"/>
Heat Lot Number: <input style="width: 90%;" type="text"/>	Heat Lot Number: <input style="width: 90%;" type="text"/>
Insert Type/Dim./Stock #: <input style="width: 90%;" type="text"/>	Insert Type/Dim./Stock #: <input style="width: 90%;" type="text"/>
Collet: <input style="width: 40%;" type="text"/> Mandrel: <input style="width: 40%;" type="text"/>	Collet: <input style="width: 40%;" type="text"/> Mandrel: <input style="width: 40%;" type="text"/>

Weldhead Size: <input style="width: 40%;" type="text"/>	Weldhead S/N: <input style="width: 40%;" type="text"/>	Power Supply S/N: <input style="width: 40%;" type="text"/>	Input Power: <input style="width: 40%;" type="text"/>
Tungsten Arc Gap: <input style="width: 40%;" type="text"/>	Tun. Geom./Length: <input style="width: 90%;" type="text"/>		
Gas Type: <input style="width: 40%;" type="text"/>	Gas Purity Level (%): <input style="width: 40%;" type="text"/>	Input Pressure (PSI): <input style="width: 40%;" type="text"/>	
Arc Gas Flow Rate (SCFH): <input style="width: 40%;" type="text"/>	Backup Gas Flow Rate (SCFH): <input style="width: 90%;" type="text"/>		
Mag. Restrictor/PSI: <input style="width: 40%;" type="text"/>	Cleaning Method/Solution: <input style="width: 90%;" type="text"/>		

Comments:

## Modifying Procedures, con't.



The third tab in MK Edit is Advanced. It allows for further modifications to an overall weld procedure (see below). This includes information such as adjusting the pre-motor time and speed, number of tacks, and degree of start position. You can also select the following options:

**Initial Home:** Forces the weldhead to move to home position before each weld.

**Final Home:** Forces the weldhead to move to home position after each weld.

**Repeat Weld:** Doesn't require user confirmation at the end of each weld. After a short delay it's ready to start the next weld.

**Data Monitor:** Enables weld performance checking to make sure that each weld is within predefined limits from Data Monitoring table.

There are also options for printing and saving the weld log.

Procedure Edit

Weld Record
Weld Data
Advanced

A/C Procedure       Tacks (Number):         Weld Start Position

Pre-Motor (Sec):         Tack Time:         Start Position (Deg.):

Pre-Motor (RPM):         Tack Current:         Max Scale (%):

Initial Home       Print Weld Log Always       Save Log To Disk Always

Final Home       Print Weld Log On Error       Save Log To Disk On Error

Repeat Weld       Short Log File

Data Monitor

### Data Monitoring

Current		Motor				Voltage					
Deviation		Abort		Deviation		Abort		Deviation		Abort	
High Pulse	Low Pulse	High	Low	High	Low						
<input type="text" value="10"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	<input type="text" value="10"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	<input type="text" value="20"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	<input type="text" value="20"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	<input type="text" value="10"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	<input type="text" value="10"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	<input type="text" value="20"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	<input type="text" value="20"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	<input type="text" value="0"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	<input type="text" value="0"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	<input type="text" value="0"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	<input type="text" value="0"/> <input type="button" value="▲"/> <input type="button" value="▼"/>
Duration (Sec)		Duration (Sec)		Duration (Sec)		Duration (Sec)		Duration (Sec)		Duration (Sec)	
<input type="text" value="0.04"/> <input type="button" value="▲"/> <input type="button" value="▼"/>		<input type="text" value="0.04"/> <input type="button" value="▲"/> <input type="button" value="▼"/>		<input type="text" value="0.04"/> <input type="button" value="▲"/> <input type="button" value="▼"/>		<input type="text" value="0.04"/> <input type="button" value="▲"/> <input type="button" value="▼"/>		<input type="text" value="0"/> <input type="button" value="▲"/> <input type="button" value="▼"/>		<input type="text" value="0"/> <input type="button" value="▲"/> <input type="button" value="▼"/>	

## Saving Procedures

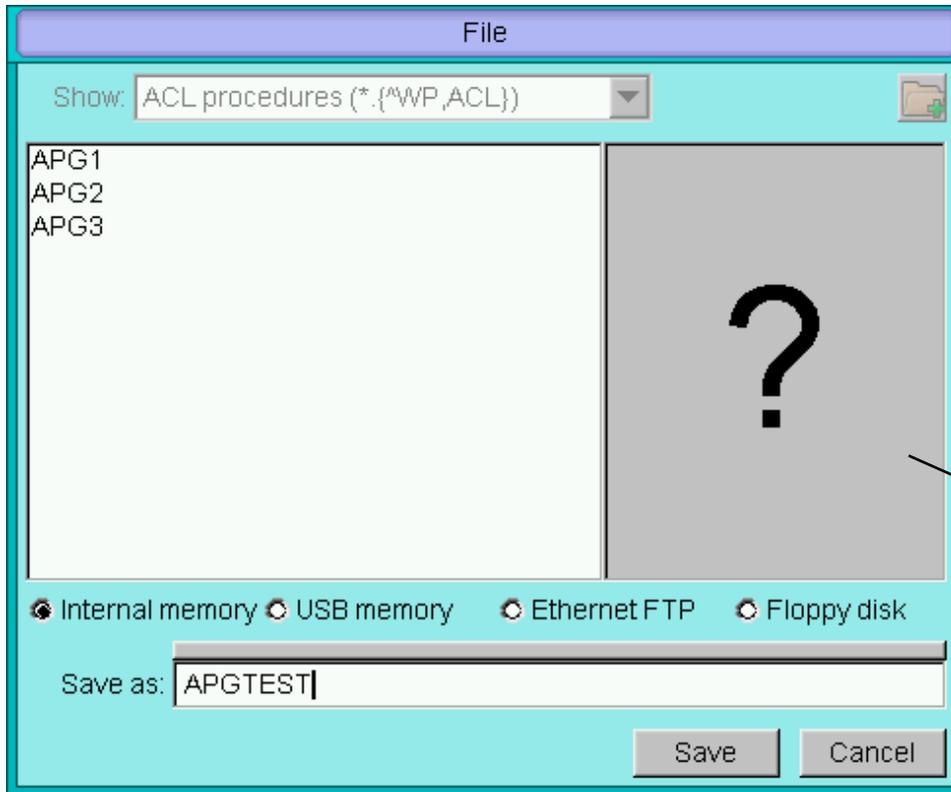
Once a weld procedure has been designed, tested, welded and modified to exact standards, it is generally a good idea to save the procedure for future use.



The first step in saving a procedure is to name it. Clicking the Save icon will save the current procedure in internal memory. This function is only available if the procedure already exists and modifications were made.



If you want to save a weld procedure under a different name, you can click the Save As icon. This will open a window that lets you type in the chosen name in the Save As field. It also lets you choose the desired location where you wish to save the procedure (see below).



Shows comments and information of the saved procedure that's selected - if no procedure is selected a question mark appears.

## Printing Weld Logs



There are a variety of printing options available with the ACL, but clicking on the Print icon will print the procedure with weld data information and the chart from the last weld.

For more information on the available printing options, or to change the default printing preferences, see Section 5, Print Menu Operations, File/Print Setup... menu on the MAIN SCREEN or use Help/Contents (or F1 key) for other helpful information.

**Please Note:** The ACL program only works with MK provided or approved printers.

# LIMITED WARRANTY

**Effective August 1, 2010**

This warranty supersedes all previous MK Products warranties and is exclusive, with no other guarantees or warranties expressed or implied.

**LIMITED WARRANTY** - MK Products Inc., Irvine, California warrants that all new and unused equipment furnished by MK Products is free from defects in workmanship and material as of the time and place of delivery by MK Products. No warranty is made by MK Products with respect to trade accessories or other items manufactured by others. Such trade accessories and other items are sold subject to the warranties of their respective manufacturers, if any.

MK Products' warranty does not apply to components having normal useful life of less than one (1) year, such as relay points, wire conduit, tungsten, and welding gun parts that come in contact with the welding wire, including gas cups, gas cup insulators, and contact tips where failure does not result from defect in workmanship or material.

MK Products shall, exclusively remedy the limited warranty or any duties with respect to the quality of goods, based upon the following options:

- (1) repair
- (2) replacement
- (3) where authorized in writing by MK Products, the reasonable cost of repair or replacement at our Irvine, California plant.

As a matter of general policy only, MK Products may honor an original user's warranty claims on warranted equipment in the event of failure resulting from a defect within the following periods from the date of delivery of equipment to the original user:

- 1. Power Supplies and Wire Feed Cabinets ..... **3 years**
- 2. Weldheads, Coolers, Positioners, and Push-Pull Guns ... **1 year**
- 3. Spool Guns, and Spool Gun Modules ..... **180 days**
- 4. Repairs/Exchanges/Parts ..... **90 days**

Classification of any item into the foregoing categories shall be at sole discretion of MK Products. Notification of any failure must be in writing within 30 days of such failure.

A copy of the invoice showing the date of sale must accompany product returned for warranty repair or replacement.

All equipment returned to MK Products for service must be properly packaged to guard against damage from shipping. MK Products not be responsible for any damages resulting from shipping.

Normal surface transportation charges (one way) for products returned for warranty repair or replacement will be borne by MK Products, except for products sold to foreign markets.

ANY EXPRESS WARRANTY NOT PROVIDED HEREIN AND ANY IMPLIED WARRANTY, GUARANTEE, OR REPRESENTATION AS TO PERFORMANCE AND ANY REMEDY FOR BREACH OF CONTRACT WHICH, BUT FOR THIS PROVISION, MIGHT ARISE BY IMPLICATION, OPERATION OF LAW, CUSTOM OF TRADE, OR COURSE OF DEALING, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR PARTICULAR PURPOSE, WITH RESPECT TO ANY AND ALL EQUIPMENT FURNISHED BY MK PRODUCTS, IS EXCLUDED AND DISCLAIMED BY MK PRODUCTS.

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