

# Welding Machine Instruction Manual

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## 210 ALUPULSE PRO DIGITAL ACDC GTAW IGBT INVERTER WELDER

## SECTION 1 – SAFETY PRECAUTIONS - READ BEFORE USING

som 2011-10

**⚠** Protect yourself and others from injury – read, follow, and save these important safety precautions and operating instructions.

### 1-1. Symbol Usage



**DANGER!** – Indicates a hazardous situation which, if not avoided, will result in death or serious injury. The possible hazards are shown in the adjoining symbols or explained in the text.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury. The possible hazards are shown in the adjoining symbols or explained in the text.

**NOTICE** – Indicates statements not related to personal injury.

Indicates special instructions.



This group of symbols means Warning! Watch Out! ELECTRIC SHOCK, MOVING PARTS, and HOT PARTS hazards. Consult symbols and related instructions below for necessary actions to avoid the hazards.

### 1-2. Arc Welding Hazards



The symbols shown below are used throughout this manual to call attention to and identify possible hazards. When you see the symbol, watch out, and follow the related instructions to avoid the hazard. The safety information given below is only a summary of the more complete safety information found in the Safety Standards listed in Section 1-6. Read and follow all Safety Standards.



Only qualified persons should install, operate, maintain, and repair this unit.



During operation, keep everybody, especially children, away.



#### ELECTRIC SHOCK can kill.

Touching live electrical parts can cause fatal shocks or severe burns. The electrode and work circuit is electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. In semiautomatic or automatic wire welding, the wire, wire reel, drive roll housing, and all metal parts touching the welding wire are electrically live. Incorrectly installed or improperly grounded equipment is a hazard.

- Do not touch live electrical parts.

- Wear dry, hole-free insulating gloves and body protection.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground.
- Do not use AC output in damp areas, if movement is confined, or if there is a danger of falling.
- Use AC output ONLY if required for the welding process.
- If AC output is required, use remote output control if present on unit.
- Additional safety precautions are required when any of the following electrically hazardous conditions are present: in damp locations or while wearing wet clothing; on metal structures such as floors, gratings, or scaffolds; when in cramped positions such as sitting, kneeling, or lying; or when there is a high risk of unavoidable or accidental contact with the workpiece or ground. For these conditions, use the following equipment in order presented: 1) a semiautomatic DC constant voltage (wire) welder, 2) a DC manual (stick) welder, or 3) an AC welder with reduced open-circuit voltage. In most situations, use of a DC, constant voltage wire welder is recommended. And, do not work alone!
- Disconnect input power or stop engine before installing or servicing this equipment. Lockout/tagout input power according to OSHA 29 CFR 1910.147 (see Safety Standards).
- Properly install, ground, and operate this equipment according to its Owner's Manual and national, state, and local codes.

- Always verify the supply ground – check and be sure that input power cord ground wire is properly connected to ground terminal in disconnect box or that cord plug is connected to a properly grounded receptacle outlet.
- When making input connections, attach proper grounding conductor first – double-check connections.
- Keep cords dry, free of oil and grease, and protected from hot metal and sparks.
- Frequently inspect input power cord for damage or bare wiring – replace cord immediately if damaged – bare wiring can kill.
- Turn off all equipment when not in use.
- Do not use worn, damaged, undersized, or poorly spliced cables.
- Do not drape cables over your body.
- If earth grounding of the workpiece is required, ground it directly with a separate cable.
- Do not touch electrode if you are in contact with the work, ground, or another electrode from a different machine.
- Do not touch electrode holders connected to two welding machines at the same time since double open-circuit voltage will be present.
- Use only well-maintained equipment. Repair or replace damaged parts at once. Maintain unit according to manual.
- Wear a safety harness if working above floor level.
- Keep all panels and covers securely in place.
- Clamp work cable with good metal-to-metal contact to workpiece or worktable as near the weld as practical.
- Insulate work clamp when not connected to workpiece to prevent contact with any metal object.
- Do not connect more than one electrode or work cable to any single weld output terminal. Disconnect cable for process not in use.

#### SIGNIFICANT DC VOLTAGE exists in inverter welding power sources AFTER removal of input power.

- Turn Off inverter, disconnect input power, and discharge input capacitors according to instructions in Maintenance Section before touching any parts.



#### HOT PARTS can burn.

- Do not touch hot parts bare handed.
- Allow cooling period before working on equipment.
- To handle hot parts, use proper tools and/or wear heavy, insulated welding gloves and clothing to prevent burns.





#### **FUMES AND GASES can be hazardous.**

Welding produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.

- Keep your head out of the fumes. Do not breathe the fumes.
- If inside, ventilate the area and/or use local forced ventilation at the arc to remove welding fumes and gases.
- If ventilation is poor, wear an approved air-supplied respirator.
- Read and understand the Material Safety Data Sheets (MSDSs) and the manufacturer's instructions for metals, consumables, coatings, cleaners, and degreasers.
- Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Always have a trained watchperson nearby. Welding fumes and gases can displace air and lower the oxygen level causing injury or death. Be sure the breathing air is safe.
- Do not weld in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form highly toxic and irritating gases.
- Do not weld on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the weld area, the areas well ventilated, and while wearing an air-supplied respirator. The coatings and many metals containing these elements can give off toxic fumes if welded.



#### **ARC RAYS can burn eyes and skin.**

Arc rays from the welding process produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin. Sparks fly off from the weld.

- Wear an approved welding helmet fitted with a proper shade of filter lenses to protect your face and eyes from arc rays and sparks when welding or watching (see ANSI Z49.1 and Z87.1 listed in Safety Standards).
- Wear approved safety glasses with side shields under your helmet.
- Use protective screens or barriers to protect others from flash, glare and sparks; warn others not to watch the arc.
- Wear protective clothing made from durable, flame-resistant material (leather, heavy cotton, or wool) and foot protection.

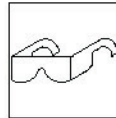


#### **WELDING can cause fire or explosion.**

Welding on closed containers, such as tanks, drums, or pipes, can cause them to blow up. Sparks can fly off from the welding arc. The flying sparks, hot workpiece, and hot equipment can cause fires and burns. Accidental contact of electrode to metal objects can cause sparks, explosion, overheating, or fire. Check and be sure the area is safe before doing any welding.

- Remove all flammables within 35 ft (10.7 m) of the welding arc. If this is not possible, tightly cover them with approved covers.
- Do not weld where flying sparks can strike flammable material.
- Protect yourself and others from flying sparks and hot metal.
- Be alert that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
- Watch for fire, and keep a fire extinguisher nearby.
- Be aware that welding on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
- Do not weld on containers that have held combustibles, or on closed containers such as tanks, drums, or pipes unless they are properly prepared according to AWS F4.1 and AWS A6.0 (see Safety Standards).
- Do not weld where the atmosphere may contain flammable dust, gas, or liquid vapors (such as gasoline).
- Connect work cable to the work as close to the welding area as practical to prevent welding current from traveling long, possibly unknown paths and causing electric shock, sparks, and fire hazards.
- Do not use welder to thaw frozen pipes.

- Remove stick electrode from holder or cut off welding wire at contact tip when not in use.
- Wear oil-free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.
- Remove any combustibles, such as a butane lighter or matches, from your person before doing any welding.
- After completion of work, inspect area to ensure it is free of sparks, glowing embers, and flames.
- Use only correct fuses or circuit breakers. Do not oversize or bypass them.
- Follow requirements in OSHA 1910.252 (a)(2)(iv) and NFPA 51B for hot work and have a fire watcher and extinguisher nearby.



#### **FLYING METAL or DIRT can injure eyes.**

- Welding, chipping, wire brushing, and grinding cause sparks and flying metal. As welds cool, they can throw off slag.
- Wear approved safety glasses with side shields even under your welding helmet.



#### **BUILDUP OF GAS can injure or kill.**

- Shut off compressed gas supply when not in use.
- Always ventilate confined spaces or use approved air-supplied respirator.



#### **ELECTRIC AND MAGNETIC FIELDS (EMF) can affect Implanted Medical Devices.**

- Wearers of Pacemakers and other Implanted Medical Devices should keep away.
- Implanted Medical Device wearers should consult their doctor and the device manufacturer before going near arc welding, spot welding, gouging, plasma arc cutting, or induction heating operations.



#### **NOISE can damage hearing.**

Noise from some processes or equipment can damage hearing.

- Wear approved ear protection if noise level is high.



#### **CYLINDERS can explode if damaged.**

Compressed gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of the welding process, be sure to treat them carefully.

- Protect compressed gas cylinders from excessive heat, mechanical shocks, physical damage, slag, open flames, sparks, and arcs.
- Install cylinders in an upright position by securing to a stationary support or cylinder rack to prevent falling or tipping.
- Keep cylinders away from any welding or other electrical circuits.
- Never drape a welding torch over a gas cylinder.
- Never allow a welding electrode to touch any cylinder.
- Never weld on a pressurized cylinder – explosion will result.
- Use only correct compressed gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
- Turn face away from valve outlet when opening cylinder valve.
- Keep protective cap in place over valve except when cylinder is in use or connected for use.
- Use the right equipment, correct procedures, and sufficient number of persons to lift and move cylinders.
- Read and follow instructions on compressed gas cylinders, associated equipment, and Compressed Gas Association (CGA) publication P-1 listed in Safety Standards.

### 1-3. Additional Symbols For Installation, Operation, And Maintenance



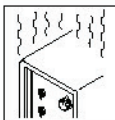
#### **FIRE OR EXPLOSION hazard.**

- Do not install or place unit on, over, or near combustible surfaces.
- Do not install unit near flammables.
- Do not overload building wiring — be sure power supply system is properly sized, rated, and protected to handle this unit.



#### **FALLING EQUIPMENT can injure.**

- Use lifting eye to lift unit only, NOT running gear, gas cylinders, or any other accessories.
- Use equipment of adequate capacity to lift and support unit.
- If using lift forks to move unit, be sure forks are long enough to extend beyond opposite side of unit.
- Keep equipment (cables and cords) away from moving vehicles when working from an aerial location.
- Follow the guidelines in the Applications Manual for the Revised NIOSH Lifting Equation (Publication No. 94-110) when manually lifting heavy parts or equipment.



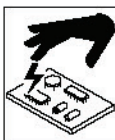
#### **OVERUSE can cause OVERHEATING**

- Allow cooling period; follow rated duty cycle.
- Reduce current or reduce duty cycle before starting to weld again.
- Do not block or filter airflow to unit.



#### **FLYING SPARKS can injure.**

- Wear a face shield to protect eyes and face.
- Shape tungsten electrode only on grinder with proper guards in a safe location wearing proper face, hand, and body protection.
- Sparks can cause fires — keep flammables away.



#### **STATIC (ESD) can damage PC boards.**

- Put on grounded wrist strap BEFORE handling boards or parts.
- Use proper static-proof bags and boxes to store, move, or ship PC boards.



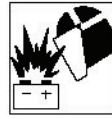
#### **MOVING PARTS can injure.**

- Keep away from moving parts.
- Keep away from pinch points such as drive rolls.



#### **WELDING WIRE can injure.**

- Do not press gun trigger until instructed to do so.
- Do not point gun toward any part of the body, other people, or any metal when threading welding wire.



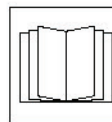
#### **BATTERY EXPLOSION can injure.**

- Do not use welder to charge batteries or jump start vehicles unless it has a battery charging feature designed for this purpose.



#### **MOVING PARTS can injure.**

- Keep away from moving parts such as fans.
- Keep all doors, panels, covers, and guards closed and securely in place.
- Have only qualified persons remove doors, panels, covers, or guards for maintenance and troubleshooting as necessary.
- Reinstall doors, panels, covers, or guards when maintenance is finished and before reconnecting input power.



#### **READ INSTRUCTIONS.**

- Read and follow all labels and the Owner's Manual carefully before installing, operating, or servicing unit. Read the safety information at the beginning of the manual and in each section.
- Use only genuine replacement parts from the manufacturer.
- Perform maintenance and service according to the Owner's Manuals, industry standards, and national, state, and local codes.



#### **H.F. RADIATION can cause interference.**

- High-frequency (H.F.) can interfere with radio navigation, safety services, computers, and communication equipment.
- Have only qualified persons familiar with electronic equipment perform this installation.
- The user is responsible for having a qualified electrician promptly correct any interference problem resulting from the installation.
- If notified by the FCC about interference, stop using the equipment at once.
- Have the installation regularly checked and maintained.
- Keep high-frequency source doors and panels tightly shut, keep spark gaps at correct setting, and use grounding and shielding to minimize the possibility of interference.



#### **ARC WELDING can cause interference.**

- Electromagnetic energy can interfere with sensitive electronic equipment such as computers and computer-driven equipment such as robots.
- Be sure all equipment in the welding area is electromagnetically compatible.
- To reduce possible interference, keep weld cables as short as possible, close together, and down low, such as on the floor.
- Locate welding operation 100 meters from any sensitive electronic equipment.
- Be sure this welding machine is installed and grounded according to this manual.
- If interference still occurs, the user must take extra measures such as moving the welding machine, using shielded cables, using line filters, or shielding the work area.



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## Preface

Congratulations on your choice of a Tokentools welding machine. Reliable and durable, Tokentools welding products are affordable to own, easy to maintain, and may help to increase your work productivity.

This user manual contains important information on the use, maintenance, and safety of your Tokentools product. The technical specifications of the device can be found at the end of the manual. Please read this manual carefully before using the equipment for the first time. For your safety and that of your working environment, pay particular attention to the safety instructions in the manual.

This manual is a living document and subject to change without prior notice therefore it is recommended to visit [www.tokenools.com.au](http://www.tokenools.com.au) for updates when they occur.

## Important notes

Items in the manual that require particular attention in order to minimise damage and personal harm are indicated with the '**NOTE!**' notation. Please read these sections carefully and follow their instructions.

## Before First Use

Tokentools products are packed into durable packages especially designed for them. Always make sure before use that the products have not been damaged during transportation. Check also, that you have received the products ordered and read this manual completely. Product packing material is recyclable however it may be prudent to keep it for long-term storage of your product when not in use.

## Transportation

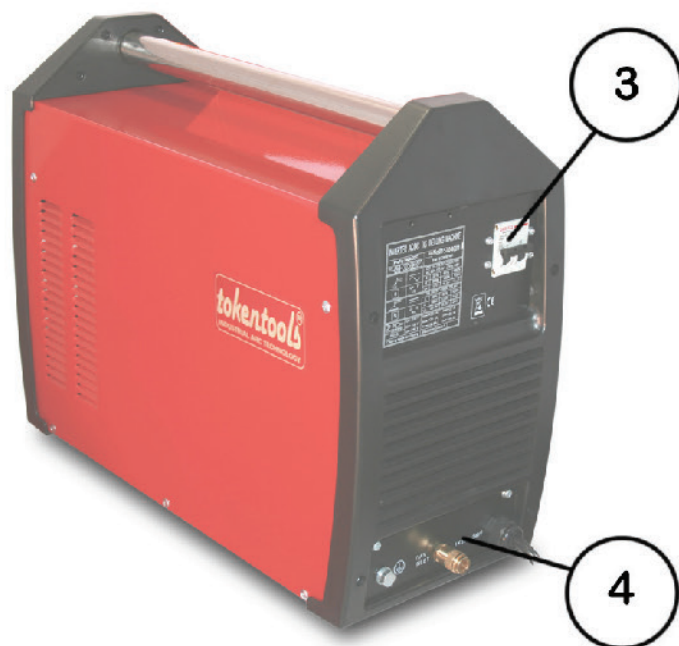
The machine should only be transported in an upright position.

**NOTE!** Always move the welding machine by the handle, never pull it by the power cord or welding torch cables. Disconnect welding & gas leads when transporting.



## Know Your Machine

Take a moment to familiarise yourself with the major components of your welding machine, these will be referred to in greater detail within the manual.



### Welding Machine Parts

1. Control Panel
2. Welding Cable Connections
3. Power Switch
4. Rear Panel



Job Clamp



TIG Welding  
Torch



MMA / Stick  
Welding  
Torch



## Control Panel & Features

The control panel allows the welding operator easy selection of parameters to accomplish the many welding tasks this product offers.

**NOTE!** – Turn adjustment knob for x1 adjustment of parameters or push knob in while turning for faster 10x adjustment of parameters.



Intuitive colour grouping makes the 210 Alupulse Pro digital welder easy to understand and use. There are several groups of coloured LED indicators that enable the operator to quickly understand which features are grouped together by identifying the colour group.

For example the Pulse Tig Welding mode LED is yellow and it also has a yellow circle around it. The pulse welding parameter section is coded along a yellow function line and has yellow LED's thus exists an association of function based on colour. The same is true for the AC waveform and it's related functions of AC frequency and balance control. The MMA welding features use red so the operator can quickly see the related settings for MMA mode. All remaining functions on the white function line are common settings that are available in different modes.

## Digital Displays



The central digital numeric display is used to display the set values for different welding parameters. It features a corresponding LED which indicates the unit of measurement for the displayed value. For example if the displayed value is 50 and the corresponding LED is illuminated adjacent to the (A) AMPS label this would mean the display is showing 50 Amps. If instead the LED adjacent to the (Hz) FREQUENCY label is on, the display would be showing 50 Hertz.

The machine's operating status is indicated by the green and amber LEDs below the central display. A green LED will be illuminated when the welding machine's power is activated. A yellow LED will illuminate adjacent to the warning triangle if there is a problem within the welding machine.



The single digit display in the upper left corner of the panel is used to indicate the memory channel currently selected. To change the memory channel simply press the adjacent button to increment the channel number by one. To save your current settings into memory press and hold the adjacent button for 4 seconds then release.

### SPECIAL MEMORY SYSTEM

The Metalmaster Pro and Elite series machines feature a special memory function that allows the operator to quickly set the machine to a predefined factory default configuration. This is especially useful when diagnosing problems with welds.

By pressing the memory button repeatedly until the letter (A) appears, settings for aluminium welding are loaded. The operator needs only to adjust amperage at a rate of 30 amps per mm of material thickness to achieve the perfect weld.

By pressing the memory button once more the letter (F) appears, settings for ferrous materials are loaded. The operator needs only to adjust amperage at a rate of 25 amps per mm of material thickness to achieve the perfect weld.

**NOTE!** Whilst using the special memory system only amperage is adjustable.

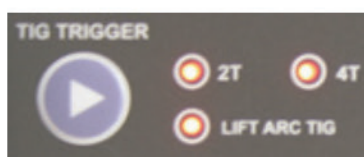


## Selecting A Welding Mode



The 210 Alupulse Pro welding machine is capable of MMA Welding (Stick) with and without VRD, Tig welding and Pulse Tig. Pressing the selector button momentarily toggles the welding mode as follows, MMA -> MMA VRD -> TIG -> PULSE TIG .

## Tig Arc Ignition

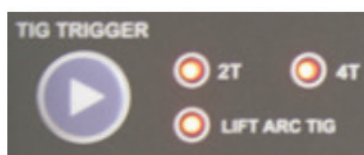


Tig arc ignition may be set to employ the HF arc ignition method or lift arc ignition method. Whilst welding in 2T mode or 4T mode the HF arc ignition method is employed. The HF arc ignition method uses electrical oscillations to create

bursts of high frequency charged pulses that ionize the welding shielding gas and jump across the gap between the tungsten electrode and work piece. The result is an arc that starts by simply pressing a push button on the Tig torch handle.

In situations where HF ignition may pose a threat to electronics or other electrical devices in the immediate vicinity of the arc such as welding on equipment directly, the HF ignition may be deactivated and the arc start set to LIFT ARC TIG instead. The lift arc start process is achieved by momentarily touching the tungsten electrode to the work piece before lifting it off. A special circuit senses the changes in circuit resistance and lowers the amperage to prevent the tungsten from sticking during the lift arc ignition process. There is still a requirement for the operator to press the push button on the Tig torch handle as this will activate the shielding gas and electrical power output of the welding machine. LIFT ARC TIG should not be confused with scratch start Tig which does not use the special circuit described above.

## TIG Torch Trigger



Pressing the trigger selector button will also toggle either 2T or 4T trigger modes. Each "T" represents a change in state of the welding torch trigger. When you push the torch button a change of state occurs. For example, pushing and releasing the torch button will result in 2 changes of state or

2T. Pushing / releasing then pushing / releasing will result in 4 changes of state or 4T.

Using trigger settings allows the welding operator to include additional welding parameters that will activate when the operator requires them by changing the trigger state during the welding process. Examples include up and down slope, start and finish crater current modes.

## 2T Mode

In 2T mode pressing the torch trigger will initiate the pre flow gas timer, start the arc at start crater value, up slope and then provide the pre-set welding current. Releasing the torch button will activate down slope until final crater current value is reached, extinguish the arc and then activate the gas post flow timer.

## 4T Mode

In 4T mode pressing the torch trigger will initiate the pre gas flow and start the arc at start crater value. The welding arc will then maintain the start crater current value. Releasing the torch trigger will activate up slope and provide the set welding current. At this point the operator does not need to hold the torch trigger to continue welding as it has been released. Pressing the tig torch trigger again will activate down slope until the final crater current value is reached and the current will remain at this value. Releasing the tig torch trigger will then extinguish the arc and activate the gas post flow timer.

The "T" represents a change in trigger value so a push and release as in the first example is two changes hence the term 2T. In the second example the welding torch trigger was pushed, released, pushed, and released again. This process included four trigger change of states hence the term 4T.

## Remote Amps Torch



A variable amps remote control torch must be used in 4T if variable current control is to be achieved. The welding operator must press and release the trigger to latch the welding current to the "on" state leaving a finger free to control and vary the welding amperage of the machine whilst welding. To stop the welding process the operator must again press and release the Tig torch trigger. It is possible to use a remote control torch in 2T mode also. By setting the variamp torch control to maximum, the operator may then select an appropriate welding current on the front panel of the machine. The welding process will then be identical to using a standard on / off torch.

## Waveform Selection



The 210 Alupulse Pro is an advanced AC/DC Tig welding power source and provides the operator with an abundance of settings that allow for maximum welding versatility. The waveform pushbutton toggles through the available welding waves.

**NOTE!** AC + DC Hybrid is only available whilst the welder is set to PULSE TIG WELDING mode. The yellow LED denotes this association



## AC Square Wave



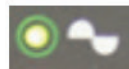
AC square waves are the most efficient for welding aluminium and provide fast responsive transitions with a focused arc for better directional control. During each half cycle of the wave the entire available energy is output for the duration of the half cycle. The AC square wave has a very distinct and harsh sound.

## AC Soft Square Wave



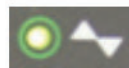
AC soft square waves provides a smoother, softer arc with a more fluid puddle than square waves. The AC soft square wave has a smoother audible tone due to the rounded corners of the wave.

## AC Sine Wave



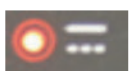
AC sine waves provide a very soft arc whilst the square wave like transitions eliminate the need for continuous HF. The AC sine wave has an almost melodic tone due to the waveform alternating in smooth rise and fall cycles.

## AC Triangular Wave



AC triangular waves create an effect similar to pulse welding, peak amperage occurs at the tip of the triangle while there is a larger current at a lower level for a longer duration. As is with pulse welding the triangular waveform reduces the overall heat input. This waveform leads to rapid puddle formation and, because of lowered heat input, reduced weld distortion, especially on thin material.

## Direct Current



Direct Current (DC) is not a waveform as it is an unchanging flow of energy with a defined cathode and anode. Direct Current is used for Tig welding, Stick welding and is suitable for Tig welding all materials except aluminium or it's alloys.

## AC + DC Hybrid



The AC + DC hybrid waveform is a sophisticated process made possible with the use of a 32 bit microprocessor and is only available during the Pulse TIG welding process. This waveform employs a combination of DC base current and AC pulse current. This type waveform increases the amount of time the job is charged positively hence increases the amount of work piece penetration when compared to other waveforms.



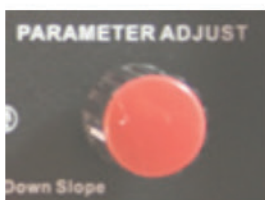
## Data Input

### Parameter Select Buttons



The function line represents the welding process and provides for visual representation of functions that may be adjusted. Movement along the function line is achieved by pressing the left or right parameter select buttons momentarily. The point of origin or default start position is welding amps. A grace period of 7 seconds is provided after shifting parameters before the chosen value returns to the default position. The grace period is extended every time a parameter adjustment is made.

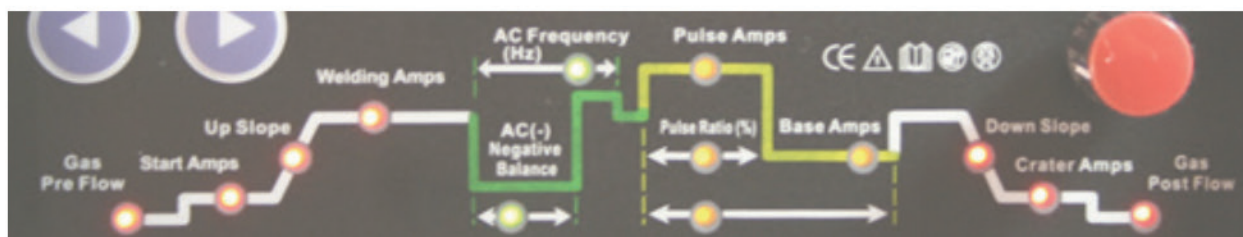
### Rotary Encoder



Data input for each parameter is achieved by rotating the parameter adjustment knob. Tactile feedback is provided by a slight click each time the knob sends a pulse to the microprocessor. Turning to the left decreases a parameter by 1 unit, turning to the right increases a parameter by 1 unit. Increased rate of change is achieved by pushing in the knob whilst turning, this allows for 10X changes of any parameter for each click.

**NOTE!** Turn adjustment knob for x1 adjustment of parameters or push knob in while turning for faster 10x adjustment of parameters.

### Function Line Parameters



The function line is a visual representation of the welding parameters that may be adjusted. Each LED represents an adjustable parameter with changes input using the rotary encoder.

### Pre Gas Flow

Pre gas flow allows the operator to set the amount of gas flow in seconds that is required for purging before the Tig welding arc is activated. The HF arc will not activate until the post flow timer has completed.

## Start Amps

The amount of amperage that is provided upon initial arc strike. In 2T mode the machine will first strike this amperage before moving on to the next parameter. In 4T mode the machine will strike an arc at this setting and remain until the torch trigger is released.

**NOTE!** In 2T mode for ease of arc strike always set start crater current to a value commensurate to the thickness of the tungsten electrode. For 1.6mm tungsten 60 Amps, for 2.4mm tungsten 100 Amps

## Up Slope

This setting increases the amount of welding current from the start crater setting to the welding amps setting over the time set. For example, if start crater is 50 amps and welding current is 170 amps with 5 seconds up slope time you would experience the welding arc as follows. Upon pressing the Tig torch trigger in 2T mode the current would start at 50 amps then immediately grow steadily for 5 seconds until it reaches 170 amps. In 4T mode upon pressing the trigger the current will start at 50 amps, when the trigger is released the current would steadily increase for 5 seconds until it reaches 170 amps.

## Welding Amps

This is the welding current used for Tig welding in AC and DC modes that do not use the pulse weld process.

## Down Slope

This setting allows the welding current to decrease over the set time until it reaches the value set at crater current. Down slope operates similarly to up slope except it reduces the welding amperage.

## Final Crater Amps

This setting determines the final amount of current supplied to the work piece and is used to avoid the creation of craters at the end of the weld. A crater can occur due to the force of the arc and rapid contraction of the molten material as it cools. By reducing the current and allowing the heat time to move away from the weld cratering is reduced.

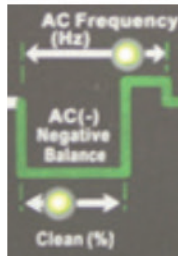
## Gas Post Flow

This setting allows shielding gas to continue flowing after the welding arc has extinguished. Both the weld bead and tungsten electrode are extremely hot and if



subjected to the atmosphere will start to oxidise and burn. By allowing the shielding gas to continue after the arc has ceased, both the tungsten electrode and weld bead will cool within a protective barrier until their heat load is not sufficient to react with the atmosphere.

## AC Welding Parameters



AC parameters may be adjusted when the selected waveform is set to AC. Whilst in DC or MMA this section is not selectable.

### AC Balance

This setting is critical for aluminium welding. AC balance sets the amount of time electrons flow from the job to the tungsten (cleaning) as opposed to their flow from tungsten to job (penetration). AC balance is expressed as a percentage of total AC cycle. For example if set to 40%, the electrons will spend 40% of the AC welding cycle flowing from the job to the tungsten electrode and the remaining proportion of 60% flowing from the tungsten to the job. Having the ability to manipulate AC balance gives an additional penetration gain over machines without balance control and allows the operator to fine tune the amount of oxide removal required for any aluminium welding process.

### AC Frequency

This setting changes the amount of AC cycles that occur each second. More alternating cycles has the effect of narrowing the arc which in turn increases penetration. Lowering the AC frequency broadens the arc so is ideal for situations where a wide / fatter bead is required.

## Pulse Welding Parameters



Pulse welding parameters may be adjusted when the selected welding mode is set to Pulse Tig. Pulse welding may be used with AC or DC welding currents. Whilst in MMA mode or non pulse Tig mode this section is not selectable.

### Pulse Amps

During the pulse welding process this setting controls the amount of pulse current. The pulse current is providing the heat that melts the material. Unlike the non pulse welding



current that is provided to the work piece at a constant rate, the pulse current is provided in bursts that can be varied in duration and intensity. Pulsing the work piece can provide excellent penetration and reduce overall heat input when compared to non pulse methods as the total heat input is an average of pulse and base currents.

## **Base Amps**

During the pulse welding process this setting controls the base amps which sets the amount of amperage that is provided between pulses. Base amperage must be set sufficiently low that it allows the material to cool and solidify between pulses. As it is not practical to extinguish the welding arc in between pulses, the base current effectively keeps the arc active but does so at a value that will not affect the weld pool.

## **Pulse Ratio**

The proportion of time the welding arc will be the higher value (pulse current) as opposed to the lower value (base current). If set at 50% the pulse and base current is applied in equal proportions. If set to 20% the pulse current will be applied for 20% of the cycle and the base current will be applied for 80% of the cycle.

An example of what is occurring may be calculated as follows. If welding 2mm sheet aluminium the operator may set the pulse current at 80 amps and base current at 20 amps with pulse ratio of 30%. In normal non pulse operation an 80 amp welding current would blow a hole right through the 2mm sheet however in pulse welding mode 80 amps welding current is provided 30% of the time and base current of 20 amps is provided 70% of the time. The resulting heat input may be calculated as follows,  $(80 \times 0.3 = 24) + (20 \times 0.7 = 14) = 38$  Amps. It would be difficult to Tig weld the material at 38 amps however using the pulse welding technique it is easy to achieve excellent penetration and do so at a reduced AVERAGE welding current.

## **Pulse Frequency**

This adjusts how fast the pulses repeat each second. Increasing pulse frequency can again narrow the arc slightly thus increasing penetration as the welding arc energy is concentrated into a smaller zone.

## **MMA Function**



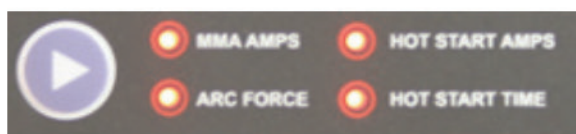
MMA or “Stick Welding” is selected by illuminating either MMA or MMA VRD LEDs within the welding function zone.

### **MMA**

When selecting MMA a voltage of 70-77VDC is available at the electrode tip.

### **MMA VRD**

In hazardous locations a safer mode is MMA VRD. The MMA Voltage Reduction Device provides a safe low voltage potential at the electrode tip that may prevent death or serious injury if the operator becomes part of the welding circuit. The welding power source constantly measures circuit impedance whilst in MMA VRD mode and upon detecting a valid short circuit releases the full welding voltage.



The MMA function is available in it's own function zone. When the MMA function is selected all LED's with a red circle around them are available for adjustment.

### **MMA Amps**

When this function selected it allows the adjustment of MMA welding amps.

### **Hot Start Amps**

Hot start amperage is a preliminary amount of amps that is available at the stick electrode during the start of the stick welding process. When first striking the stick electrode a higher amperage can be set in order to heat up the electrode tip and provide a very smooth arc start.

### **Hot Start Time**

Hot start time is the setting that allows hot start amps to occur for “X” value of seconds. If for example the operator set hot start time at 2 seconds, hot start amps at 100A and welding amps at 70A the following would occur, upon striking the arc an amperage of

100A would be available for 2 seconds followed by normal welding amperage of 70A for the remainder of the welding bead until the arc is broken.

## Arc Force

Changing the arc length of the MMA electrode can negatively affect the penetration of the weld and when the arc length is too small the rod may stick to the work piece. Arc force allows the welding amperage to increase when this occurs and will prevent the rod sticking and maintain a suitable power level to the weld bead.

## MMA Polarity

In MMA mode the available output is DC. To change polarity of the torch / the operator must swap the connections on the front of the welding machine.

## Welding Cable Connections



### TIG Welding AC & DC Modes

(FP1) used for the connection of the job clamp to the work piece.

(FP4) used for connection of the Tig Torch.

(FP3) used for connection of the TIG Torch trigger control cable.

(FP2) used for connection of the TIG torch shielding gas connector.

### MMA Welding

(FP1) used for connection of the MMA / Stick welding torch.

(FP4) used for connection of the job clamp to the work piece.



## Rear Panel

### Rear Panel Layout

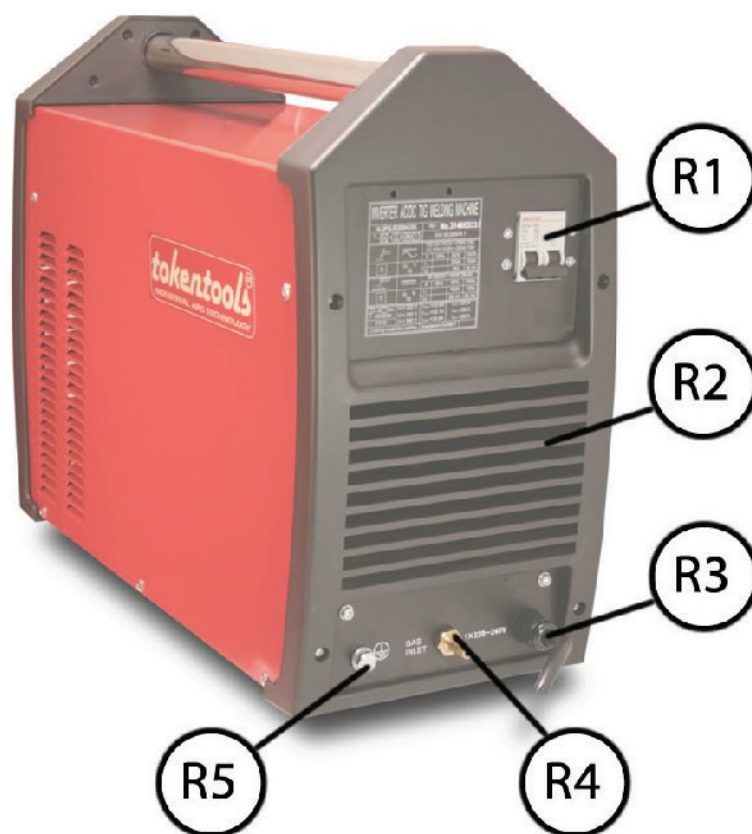
The rear panel contains the main power switch, 240V mains powered input supply cord, shielding gas input barb, cooling fan intake vent and supplementary grounding bolt.

(R1) The main on / off switch is a double pole isolator and circuit breaker. Flicking the lever in the upward position activates the welding power source.

(R2) Cooling air is drawn into the rear vent and is exhausted via the front and side vents. Keep vents at least 250mm clear of obstruction whilst the machine is in use.

(R3) The 240V mains electrical cord is fitted with a 15A plug.

(R4) Shielding gas is supplied to the machine from the regulator via input gas barb.



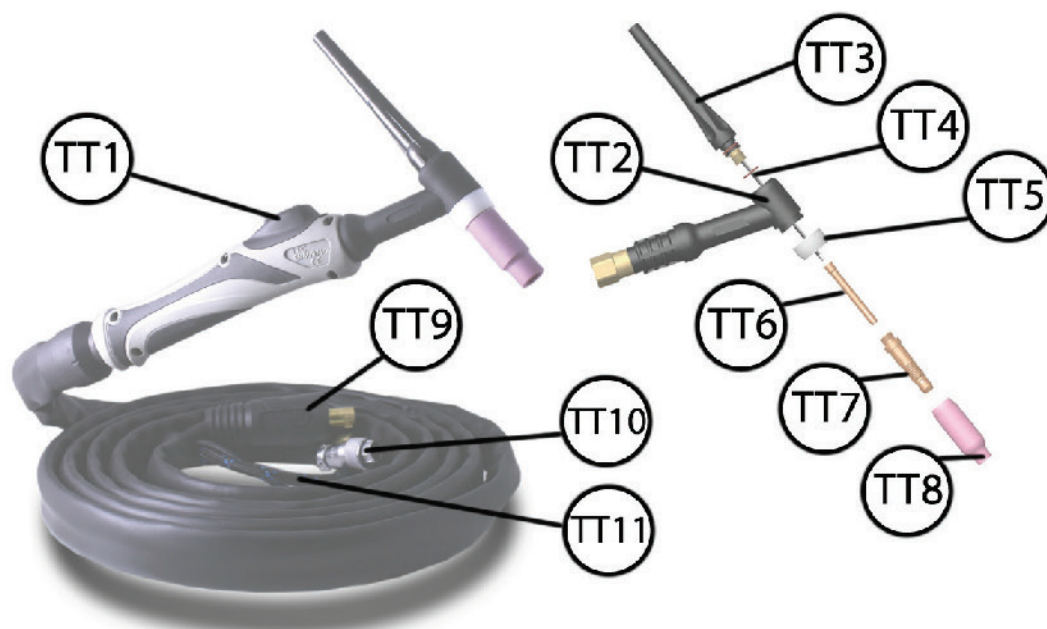
(R5) An external ground connection bolt is provided to allow for supplementary shielding cables / faraday shielding to be easily bonded to the mains. The welding power source is already grounded via the 3 pin plug to the mains ground, for normal operation (R5) is not required.

**NOTE!** Ensure the cooling fan intake vent is clear to allow adequate air flow to keep the welding machine cool. Avoid the ingress of debris by keeping the machine off the floor.

# Welding Torches

## TIG Welding Torch

The supplied TIG welding torch is 4M in length and is compatible with accessories and parts designed to fit the Binzel 26 torches.



**NOTE!** Always install the collet so that the split end points to the welding tip of the tungsten

## Assembly Of The TIG Torch

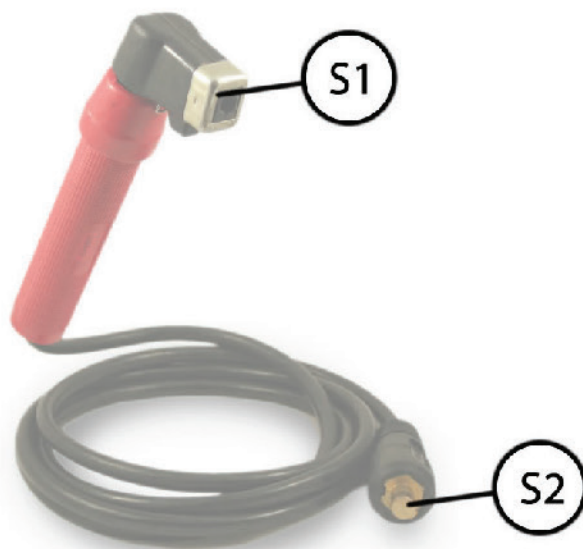
Supplied with the TIG torch is a TIG torch accessories kit. Inside you will receive a back cap (TT3), several collets (TT6), a collet body (TT7) and several ceramic nozzles (TT8). Before TIG welding may be undertaken the TIG torch will require assembly. Install the collet body into the TIG torch (TT2) head by screwing it in firmly. Install the desired ceramic nozzle onto the collet holder ensuring it presses firmly against the cup gasket insulator (TT5). Install your collet (TT6) onto the tungsten electrode (TT4) and insert both into the rear of the torch head. Install the back cap (TT3) over the tungsten and tighten gently. Allow the tungsten to slip past the ceramic nozzle approximately 3-6mm and firm up the back cap so that the pressure on the collet locks the tungsten into place.

## Connecting The TIG Torch

TIG welding operations are undertaken with a negatively charged tungsten electrode, therefore the TIG torch dinse connector (TT9) must be plugged into the front panel negative socket (FP1) and the welding job clamp must be plugged into (FP3). The brass gas connector on the TIG torch (TT11) is plugged into the female gas coupling on the front panel (FP6). The TIG torch push button control connector (TT10) is connected to the 7 pin female socket on the front panel (FP2).

## MMA Welding Torch

The MMA welding torch is used for performing stick welding operations. The Australian style stick welding torch is easy to use and durable.



### **Stick Torch Connection**

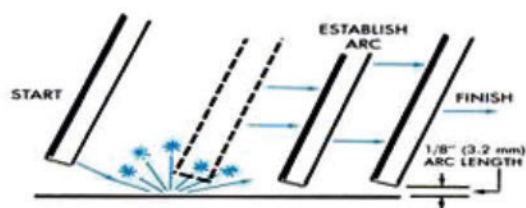
Insert an MMA electrode by twisting torch head (S1) anti-clockwise until the tongue lifts. Insert the electrode and lock it into place by turning the head clockwise.

The MMA torch dinse plug (S2) must be plugged into (F3) on the front panel so that it may be positively charged.

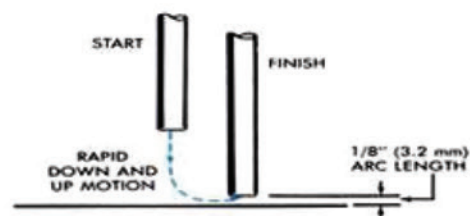
## Arc Starting Method

There are two ways to start an arc welding arc. The first way is to scratch the MMA electrode across the work piece. The second way is to tap the electrode against the work piece. Inverter welders provide excellent arc start capability due to their high open circuit voltage and DC welding current output.





Scratch



Tap

## Using Shielding Gas

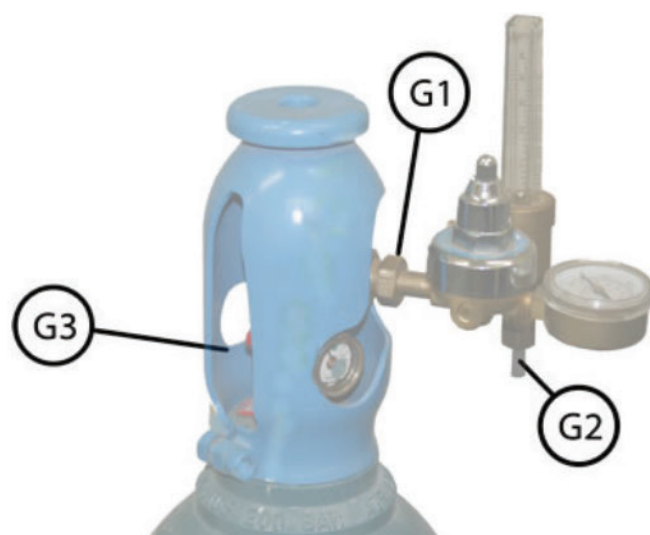
### Selection Shielding Gas

Welding process	Appropriate Gas
MIG (GMAW) STEEL	80/20 Ar/CO <sub>2</sub> or 75/25 Ar/CO <sub>2</sub>
MIG (GMAW) STAINLESS	98/2 Ar/O <sub>2</sub>
MIG (GMAW) ALUMINUM	100% Argon
DC TIG (GTAW)	100% Argon

Flow rates will depend on the type of material being welded and the type of shielding gas being used. Please reference the "Welding – Getting Started" section in this manual.

### The Shielding Gas Regulator

If you have separately purchased a gas regulator you will find it enclosed within your welding machine package.



Install the shielding gas regulator to the gas bottle at (G1), use a shifter to tighten it.

Connect the shielding gas hose to the outlet barb on the gas regulator at (G2)

When ready to weld, activate the shielding gas cylinder by opening the main gas valve at (G3) and adjust your flow rate at required.

**NOTE!** The solenoid built into the welder will activate and deactivate shielding gas as required during TIG and MIG welding operations. At the conclusion of welding it is **STRONGLY** recommended to deactivate the gas supply at the main gas bottle valve (G3). Failure to do so may result in minute leakage from the solenoid which over a prolonged period of time will empty the shielding gas cylinder.

## Welding – Getting Started

The welding processes and information contained within this manual are of a general nature and may be referenced when selecting a welding process to be used on this welding machine. Welding is a broad topic and welding operators are encouraged to undertake tertiary education to achieve a deeper level of technical skill & knowledge.

### Torch Polarity Based On Welding Process

Welding Process	Torch	Work Piece
TIG (GTAW)	-	+
STICK (SMAW)	+	-

### DC TIG Welding Data

Tungsten	Amperage	Material Thickness	Gas Flow Rate
1.6 mm	5 – 120A	0.20 mm – 4.50 mm	7-12 Litres / Per Minute
2.4 mm	120 – 200A	4.50 mm – 8.00 mm	12-20 Litres / Per Minute

### AC TIG Welding Data (Balance 40%)

Tungsten	Amperage	Material Thickness	Gas Flow Rate
1.6 mm	5 – 90A	0.20 mm – 4.50 mm	7-12 Litres / Per Minute
2.4 mm	90A – 200A	4.50 mm – 8.00 mm	12-20 Litres / Per Minute

### DC MMA Welding Data

MMA Rod	Amperage	Material Thickness
1.5 mm	20 – 50A	1.00 mm – 3.00 mm
2.0 mm	40 – 90A	2.50 mm – 4.00 mm
3.2 mm	75 – 125A	3.00 mm – 6.00 mm
4.0 mm	125 – 160A	4.50 mm – 7.00 mm
5.8 mm	140 – 210A	6.50 mm – 8.00 mm



# TIG Welding

## Overview

TIG welding is a process that uses a constant current (CC) power source, a shielding gas and a TIG torch fitted with a tungsten electrode. An electric arc is formed between the tungsten electrode and the work piece. The tungsten and the welding zone is protected from the surrounding air by a gas shield comprised of inert gas. The electric arc can produce temperatures in excess of 8000 Degrees celcius and this heat can be very focused and localized to a very small weld pool area. The weld pool can be used to join the base metal with or without additional filler material.

## Selecting A Gas Nozzle

The diameter of a TIG welding alumina cup exit port (diameter closest to the arc where the shielding gas exits) is available in a variety of sizes. The exit port diameter for any alumina cup is specified with a number that represents the diameter in 1.6 mm increments or 1/16ths of an inch. A number 5 cup is therefore 5/16ths of an inch or 8 mm in diameter. A number 6 cup is 6/16ths of an inch or 9.6 mm in diameter and so on.

TIG welding alumina cups are also available in various lengths from short nozzles to extra-long nozzles and widths to accommodate collet bodies or gas lenses.

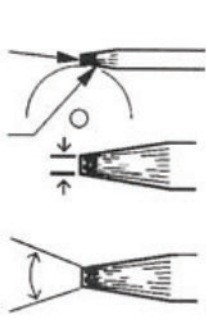
Alumina cups are the most commonly used gas nozzles in TIG Welding. Alumina cups are made from alumina oxide which has a very high melting point. The diameter for any nozzle must be large enough to allow the entire weld area to be covered by the shielding gas. The exit diameter can be neither too large nor too small, or poor shield gas coverage will result.

## Using The Right Tungsten

The output current within this TIG welder is selectable as either AC (Alternating Current) or DC (Direct Current). Suitable tungsten electrodes include, pure tungsten, or alloyed tungstens such as thoriated 2%, ceriated 2% , lanthanated 2% or zirconiated 2%. Suitable tungsten diameters for this machine are 1.6mm and 2.4mm in either 175mm or 150mm lengths.

## Sharpening The Tungsten

Tungsten must be sharpened along it's long axis so that any scratches left on the surface will run toward the tip.



Shape by grinding longitudinally (never radially). Remove the sharp point to leave a truncated point with a flat spot. Diameter of flat spot determines amperage capacity.

The included angle determines weld bead shape and size. Generally, as the included angle increases, penetration increases and bead width decreases.

Use a medium (60 grit or finer) aluminium oxide wheel.

## Striking A TIG Arc

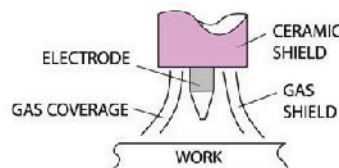
### HF Arc Ignition

In order to strike a TIG welding arc using the HF start circuit, once set up in TIG welding mode with 2T or 4T selected, the operator will need to press the TIG torch push button (TT1) and strike the arc whilst keeping the tungsten electrode a few millimeters from the work piece.

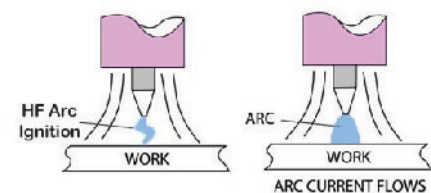
### Lift Arc Ignition

Striking an arc in lift Tig mode is achieved by selecting "Lift Arc Tig" from the Trigger zone then pressing the TIG torch push button (TT1) and touching the tungsten electrode to the work piece followed by a gentle lift not exceeding 5mm.

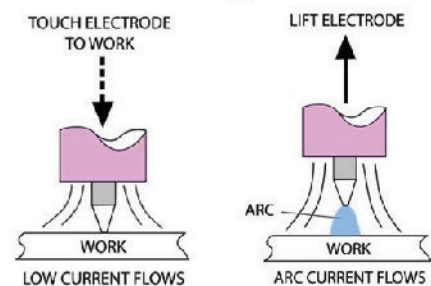
**NOTE!** A special circuit detects when the tungsten electrode touches the work piece and reduces the welding current to only a few amps reducing electrode stick as is common on cheap scratch start Tig welding machines.



### Push Button Ignition

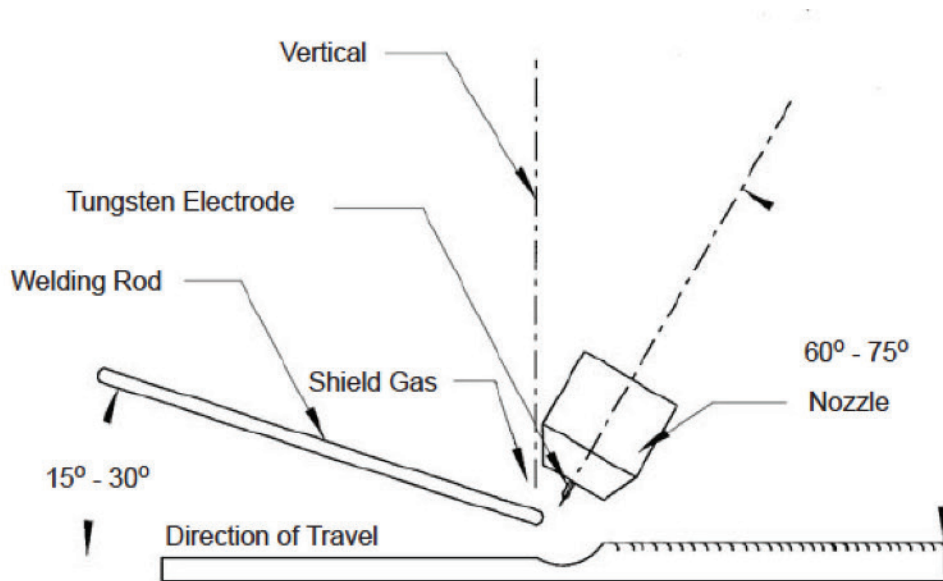


### Lift Arc Ignition



## Correct TIG Torch & Filler Rod Position

The suggested electrode and welding rod angles for welding a bead on plate are indicated in the image below. The same angles are used when making a butt weld. The torch is held 60° - 75° from the material surface. This is the same as holding the torch 15° - 30° from the vertical. Take special note that the rod is in the shielding gas during the welding process.



## **MMA (Stick) Welding**

### Overview

Manual Metal Arc (MMA) is commonly known as Stick Welding and is really a melting and casting process in miniature. The various components of the welding process (base metal, weld metal slag, etc.) form the crucible and contents of a tiny electric furnace.

The electric arc, with a temperature of at least 6,000 Degrees Celsius is a concentrated and efficient source of heat. This heat is utilised in the metal arc welding process by employing a flux-coated electrode to provide filler metal.

The electrode and parent metal act as poles of the arc, the core wire of the electrode melting and being transferred across the arc to coalesce with the molten parent metal and form a bond which in most cases, is stronger than the parent metal. The flux



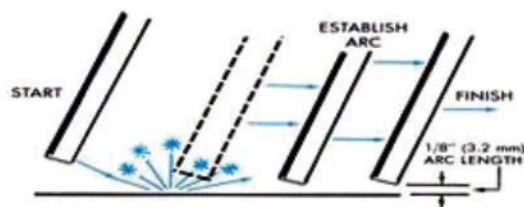
covering melts more slowly than the core wire and a cup is formed at the electrode tip which assists in directing the molten droplets to the required spot.

The weld metal itself, as deposited, has a cast structure, its composition is determined by the core wire and coating of the electrode, and by the amount of pick-up of parent metal during welding. For example, a deposit of alloy steel, say, stainless steel on mild steel, no longer has just the properties expected of that alloy, due to dilution with the parent metal. This effect, in many cases, is not important, but, if desired, it may be eliminated by using multi-layer welds.

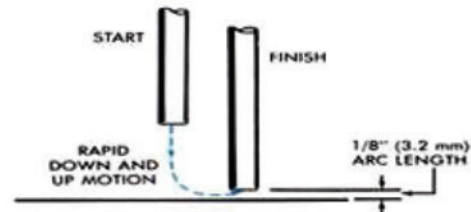
Welding on materials that have been strengthened by heat-treatment or cold-working generally creates a zone of lower strength along the weld boundary. This may not affect the serviceability of the welded joint, but sometimes it is necessary to restore this strength by further heat-treatment or cold-work.

### Arc Starting Method

There are two ways to start an arc welding arc. The first way is to scratch the MMA electrode across the work piece. The second way is to tap the electrode against the work piece. Inverter welders provide excellent arc start capability due to their high open circuit voltage and DC welding current output.



## Scratch



## Tap

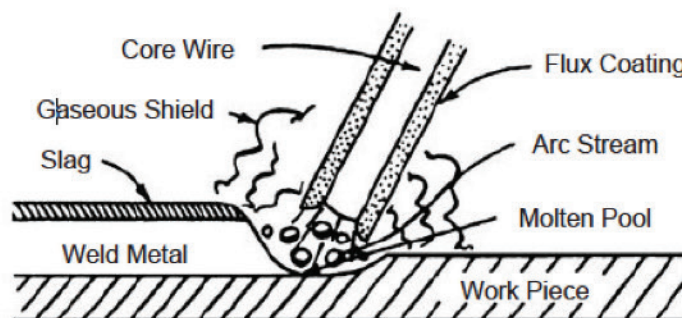
### Arc Blow

Arc blow is peculiar to DC MMA welding. The welding arc, instead of playing steadily on one spot, is deflected away from the point of welding due to the influence of surrounding magnetic fields created by welding currents flowing in the work. To overcome such a situation try repositioning the welding job clamp to another part of the work piece.

## Running Beads

If you have not yet done any welding, the simplest way to commence is to run beads on a piece of scrap plate. Use mild steel plate about 12 mm thick and a 4.0 mm electrode. Clean any paint, loose scale or grease off the plate and set it firmly on the work bench so that welding can be carried out in the down hand position. Make sure that the earth clamp is making good electrical contact with the work, either directly or through the work table. For light gauge material, always clamp the earth lead directly to the job, otherwise a poor circuit will probably result.

It is important to understand how the MMA process works and practice on scrap material so that you may quickly gain the skills required to produce strong penetrating welds with excellent bead appearance.



## MMA Welding Current

Suitable amperages for the various sizes of electrodes are usually printed on the packets. These amperages may be varied to suit conditions — welds on thin plate require low amperages to prevent burn-through, while high welding rates or deep penetration of the weld metal require higher amperages. For 4.0 mm rods set the machine at about 160 Amps.

There are several effects produced by incorrect amperage setting. If it is too high, spatter becomes excessive, and the weld pool becomes very hot, producing a flattened bead with elongated ripple marks, and the electrode overheats.

If the current is too low, it is difficult to maintain the arc and prevent the electrode from sticking, the bead is high and rounded, with poor edge fusion, and penetration is slight. Figures 3, 4 and 5 show the effects of different amperages.

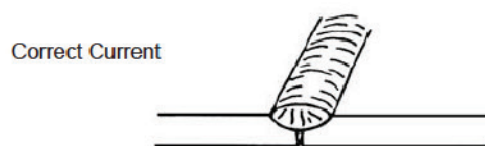


Fig. 3



Fig. 4

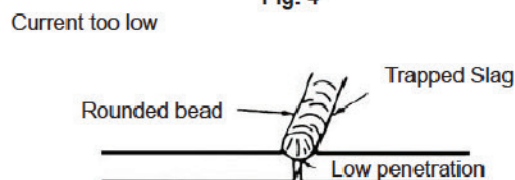


Fig. 5

## Specifications

Brand:

- ☒ Metalmaster
- ☒ Registered Australian Trademark - YES

Warranty:

- ☒ 5 Years Parts & Labour

Power Requirement:

- ☒ 1 x 240 Volt 15 Amp Supply - Single Phase

Welding Process:

- ☒ Hybrid Pulse Welding (AC + DC )
- ☒ Pulse Welding
- ☒ AC Tig Welding
- ☒ DC Tig Welding
- ☒ DC MMA Welding

At A Glance :

- ☒ 2T / 4T Trigger Latching
- ☒ Pre Flow Shielding Gas Timer
- ☒ Adjustable Start Amps
- ☒ Adjustable Finish Amps
- ☒ Welds Aluminium
- ☒ Welds Stainless Steel
- ☒ Welds Other Metals
- ☒ Adjustable AC Welding Frequency
- ☒ Adjustable AC Balance / Cleaning Action
- ☒ Hybrid Pulse Welding Mode (AC + DC)
- ☒ Pulse Welding Mode
- ☒ Adjustable Pulse Width / Duty
- ☒ Adjustable Pulse Welding Frequency
- ☒ Arc Force
- ☒ Hot Start Amps
- ☒ Hot Start Time



- ☒ VRD (Voltage Reduction Device)
- ☒ Post Flow Shielding Gas Timer
- ☒ Up Slope
- ☒ Down Slope
- ☒ Push Button Start HF Ignition
- ☒ Preset Amps Control / Display

Inverter Type:

- ☒ IGBT - Siemens / Infineon Power Transistors

Dimensions and weight:

- ☒ L50cm x W23cm x H44cm
- ☒ Weight - 25 Kilograms

## Tig Welding Features

Arc Ignition:

- ☒ Lift Arc
- ☒ Push Button Start (HF)

Gas Control:

- ☒ Preflow - 0 to 10 seconds
- ☒ Electric Solenoid activates when torch trigger is pressed
- ☒ Postflow - 1 to 25 seconds

Waveform Control:

- ☒ AC Balance - 10% to 90%
- ☒ AC + DC Hybrid Wave Frequency - 1Hz to 10Hz
- ☒ AC Sine Wave Frequency - 10Hz to 250Hz
- ☒ AC Soft Square Wave Frequency - 10Hz to 250Hz
- ☒ AC Square Wave Frequency - 10Hz to 300Hz
- ☒ AC Triangular Wave Frequency - 10Hz to 250Hz
- ☒ DC Pulse Width
- ☒ DC Pulse Frequency

- ☒ AC & DC Pulse Width
- ☒ AC & DC Pulse Frequency

Tig Welding Amps Range:

- ☒ DC Amps 5 to 210
- ☒ AC Amps 10 to 210

Tig Welding Waveform:

- ☒ AC Square Wave
- ☒ AC Sine Wave
- ☒ AC Soft Square Wave
- ☒ AC Triangular Wave
- ☒ AC + DC Mixed Mode (Pulse Tig Only)
- ☒ DC

Pulse Welding Features:

- ☒ AC + DC Hybrid Wave Frequency - 1Hz to 10Hz
- ☒ AC Pulse Frequency 0.1Hz to 250Hz
- ☒ Pulse Duty - 10% to 90%
- ☒ Pulse Amps AC - 5 to 210
- ☒ Pulse Amps DC - 5 to 210
- ☒ DC Pulse Frequency - 0.1Hz to 500Hz

Remote Amps Control Capable:

- ☒ Yes
- ☒ Foot Pedal Compatible
- ☒ Variable Amps Torch Compatible

Slope Control:

- ☒ Yes
- ☒ Up Slope - 1 to 10 seconds
- ☒ Down Slope - 1 to 10 seconds

Crater Current:

- ☒ Available by selecting 2T mode
- ☒ Available by selecting 4T mode
- ☒ Start Crater - 5 to 150 Amps

- ☒ Finish Crater - 5 to 150 Amps

## MMA Welding Features

MMA Welding Amps Range:

- ☒ 10 to 175 Amps

MMA Current Waveform Control:

- ☒ DC
- ☒ MMA with VRD Activated
- ☒ MMA with VRD Deactivated
- ☒ Hot Start Amps
- ☒ Hot Start Amps Time

## Duty Cycles

Tig Welding Duty Cycles:

- ☒ 160 Amps @ 100% Duty
- ☒ 210 Amps @ 60% Duty

MMA Welding Duty Cycles:

- ☒ 100 Amps @ 100% Duty
- ☒ 175Amps @ 60% Duty

## What is in the box?

All items listed are included in the standard package:

- ☒ 1 x Alupulse 210 Pro Digital Inverter Welding Power Supply



- ☒ 1 x 4 Metre Binzel Compatible 26 Series Ergonomic Tig Torch
- ☒ 1 x 3 Meter MMA Twist Lock Torch and Cable
- ☒ 1 x 3 Meter Job Clamp and Cable
- ☒ 1 x Reinforced gas Line
- ☒ 1 x Tig Torch Accessory Kit
- ☒ 1 x Instruction Manual