



USER MANUAL

GRAND MIG 201

P U L S E P F C

IMPORTANT: Read this OPERATOR MANUAL together with PRESCRIPTION AND COMPLIANCE MANUAL before to use this equipment. In case of loss one of two parts contact immediately your dealer.

Allow the operator to consult this manual.

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1 INSTALLATION WARNING

This machine is certified according to 60974 - 10:2014 Arc Welding Equipment Part 10: Electromagnetic compatibility (EMC) requirement and the EUT belongs to Group 2 Class A. **WARNING: This Class A equipment is intended for industrial use and it is not intended for use in residential locations where the electrical power is provided by the public low-voltage supply system. There may be potential difficulties in ensuring electromagnetic compatibility in those locations, due to conducted as well as radiated disturbances.**

WARNING: This equipment does not comply with IEC 61003-12. If it is connected to a public low-voltage system, it is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment may be connected.

Assessment of area

Before installing arc welding equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:

- a) other supply cables, control cables, signalling and telephone cables, above, below and adjacent to the arc welding equipment;
- b) radio and television transmitters and receivers;
- c) computer and other control equipment;
- d) safety critical equipment, for example guarding of industrial equipment;
- e) the health of the people around, for example the use of pacemakers and hearing aids;
- f) equipment used for calibration or measurement;
- g) the immunity of other equipment in the environment. The user shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures;
- h) the time of day that welding or other activities are to be carried out.

The size of the surrounding area to be considered will depend on the structure of the building and other activities that are taking place. The surrounding area may extend beyond the boundaries of the premises.

Methods of reducing emissions

Public supply system

Arc welding equipment should be connected to the public supply system according to this manual recommendations. If interference occurs, it may be necessary to take additional precautions such as filtering of the public supply system. Consideration should be given to shielding the supply cable of permanently installed arc welding equipment, in metallic conduit or equivalent. Shielding should be electrically continuous throughout its length.

The shielding should be connected to the welding power source so that good electrical contact is maintained between the conduit and the welding power source enclosure

Maintenance of the arc welding equipment

The arc welding equipment should be routinely maintained according to this manual recommendations. All access and service doors and covers should be closed and properly fastened when the arc welding equipment is in operation. The arc welding equipment should not be modified in any way, except for those changes and adjustments covered in this manual. In particular, the spark gaps of arc striking and stabilising devices should be adjusted and maintained according to our recommendations.

Welding cables

The welding cables should be kept as short as possible and should be positioned close together, running at or close to the floor level.

Equipotential bonding

Bonding of all metallic objects in the surrounding area should be considered. However, metallic objects bonded to the work piece will increase the risk that the operator could receive an electric shock by touching these metallic objects and the electrode at the same time. The operator should be insulated from all such bonded metallic objects.

Earthing of the workpiece

Where the workpiece is not bonded to earth for electrical safety, nor connected to earth because of its size and position, for example, ship's hull or building steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitance, selected according to national regulations.

Screening and shielding

Selective screening and shielding of other cables and equipment in the surrounding area may alleviate problems of interference. Screening of the entire welding area may be considered for special applications.

2 OVERVIEW

2.1 Features

- New PWM technology and IGBT inverter technology.
- Active PFC technology for increased duty cycle and energy efficiency.
- Multi voltage input, can use with long extension lead.
- MIG/MAG with Pulse SYN/Dual pulse SYN/Manual and SYN function
 - Synergic programs for aluminum, mill steel, stainless steel and CuSi
 - JOB mode (Save and call 100 different job records)
 - 2T /4T/S4T/Spot Weld welding mode
 - function parameter adjustment
- MMA function (Stick electrode)
 - Hot start (improves electrode starting)
 - Adjustable Arc Force
- DC TIG
 - Lift Arc ignition (prevents tungsten sticking during arc ignition)
 - 2T /4T Trigger Control
 - Adjustable Down slope
 - Gas/air cooling mode
- Internal wire feeder, gear driven for up to 300mm Ø spool
- Euro MIG torch connection
- IP23 rating for environmental/safety protection
- Spool Gun Connection

2.2 Technical Data

Models	GRAND MIG 201 PULSE PFC					
Parameters	1~110/120/130±10%			1~220/230/240±10%		
Input Voltage (V)	1~110/120/130±10%			1~220/230/240±10%		
Frequency (HZ)	50/60					
	MIG	TIG	MMA	MIG	TIG	MMA
Input Current (I _l max) (A)	35	29	30	27	20	30
Input Power (KW)	4.0	3.2	3.5	6.2	4.2	6.2
Welding Current (A)	40-140	10-150	10-110	40-200	10-200	
Welding Voltage (V)	14.8-26.5 (MIG)					
No-load Voltage (V)	78.5 (MIG)					
Duty cycle (40°C)	30% 140A 60% 110A 100% 85A	40% 150A 60% 125A 100% 95A	30% 110A 60% 80A 100% 65A	30% 200A 60% 145A 100% 110A	35% 200A 60% 155A 100% 120A	25% 200A 60% 130A 100% 100A
Diameter (mm)	Fe:0.6/0.8/0.9/1.0/1.2 SS:0.8/0.9/1.0/1.2 Flux-Cored:0.6/0.8/0.9/1.0/1.2 Al:1.0/1.2					
Protection class	IP23					
Insulation class	H					
Dimensions (mm)	700*280*460					
Weight (Kg)	20					
Power Factor	0.99					

2.3 Brief Introduction

GRAND MIG 201 PULSE PFC is an inverter-based MIG/MMA/TIG welding machine with Synergic Programs and Dual pulse functions. The MIG function allows you to weld with Gas Shielded wire applications giving excellent, professional welding results. Easy step-less adjustment of voltage and wire feed coupled with integrated digital meters allows easy setting of welding parameters. GRAND MIG 201 PULSE PFC features MIG welding with Synergic welding programs designed for ease of use with your selected gas mixture. The operator selects the gas mixture and wire diameter they are using then simply start welding. Once this is done the operator can make fine adjustments to the voltage for even greater control of the weld pool. The added Lift - Arc DC TIG capability delivers perfect arc ignition every time and a remarkably smooth stable arc produces high quality TIG welds. TIG functionality includes adjustable Down Slope & Post Gas as well as being gas solenoid - valve equipped. The stick welding (MMA) capability delivers easy electrode welding with high quality

results, including cast Iron, stainless and low hydrogen. An additional feature is the Spool gun ready function that allows the simple connection of Spool Gun for the use of thin or softer wires that don't have the column strength to feed through MIG torches, such as aluminum wire. In the JOB mode, 100 different JOB records can be stored and called, improve the quality of welding process.

GRAND MIG 201 PULSE PFC is an industrial quality machine that is suitable for all positions welding for various plates made of stainless steel, carbon steel, alloyed steel etc. Applications applied to pipe installment, petrochemical, architecture equipment, car repair, handicraft and common steel fabrication.

GRAND MIG 201 PULSE PFC has built-in automatic protection functions to protect the machines from over-voltage, over-current and over-heat. If any one of the above problems happens, the alarm lamp on the front panel will be lit and output current will be shut off automatically for the machine to protect itself and prolong the equipment using life.

2.4 Duty cycle and Over-heat

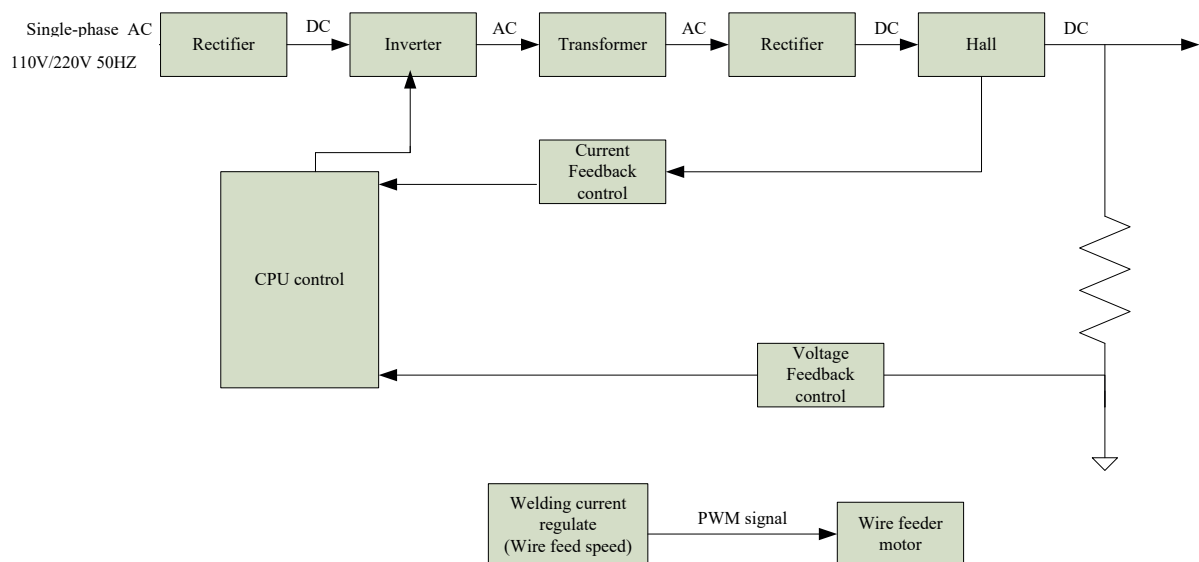
The letter "X" stands for Duty Cycle, which is defined as the portion of the time a welding machine can weld continuously with its rated output current within a certain time cycle (10 minutes).

The relation between the duty cycle "X" and the output welding current "I" is shown as the right figure.

If the welding machine is overheating, the IGBT over-heat protection sensing will send a signal to the welding machine control unit to cut the output welding current OFF and light the over-heat pilot lamp on the front panel. In that case, the machine should not be welding for 10-15 minutes to cool down with the fanrunning. When operating the machine again, the welding output current or the duty cycle should be reduced.

2.5 Working Principle

The working principle of GRAND MIG 201 PULSE PFC is shown as the following figure. Single-phase 110V/220V work frequency AC is rectified into DC (530V), then is converted to medium frequency AC (about 20KHz) by inverter device (IGBT), after reducing voltage by medium transformer (the main transformer) and rectifying by medium frequency rectifier (fast recovery diodes), and is outputted by inductance filtering. The circuit adopts current feedback control technology to insure current output stably when MMA or TIG. And adopts voltage feedback control technology to insure voltage output stably when MIG. Meanwhile, the welding current parameter can be adjusted continuously and infinitely to meet with the requirements of welding craft.

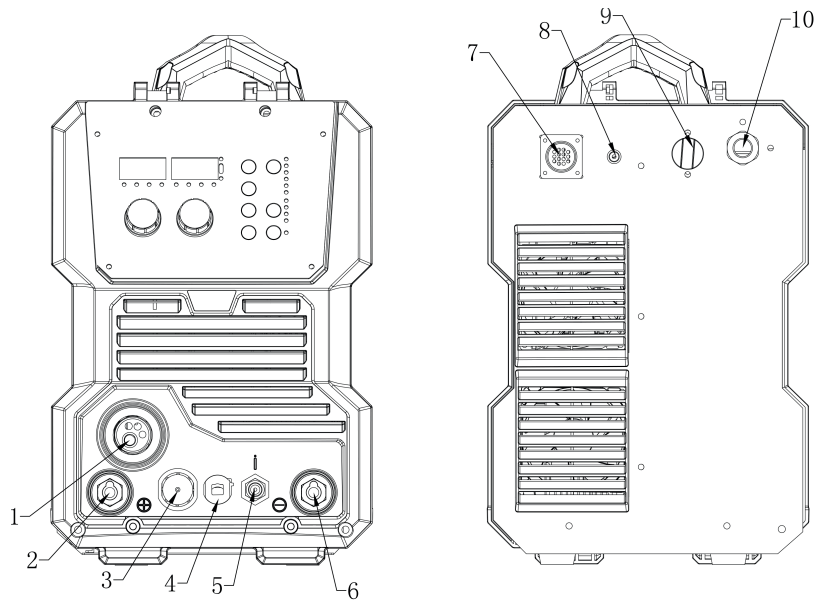


3 Panel Functions & Descriptions

3.1 Machine Layout Description

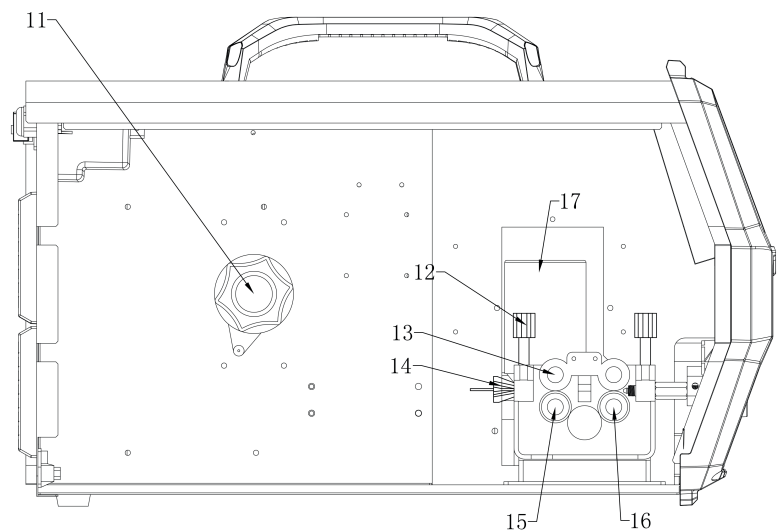
Front and rear panel layout of welding machine

1. MIG torch euro connector.
2. Positive (+) welding power output connection socket.
3. Remote connection plug.
4. MIG Torch Polarity Change Power Connection.
5. TIG torch gas connector.
6. Negative (-) welding power output connection socket.
8. Gas inlet connector.
9. Power switch.
10. Input power cable.



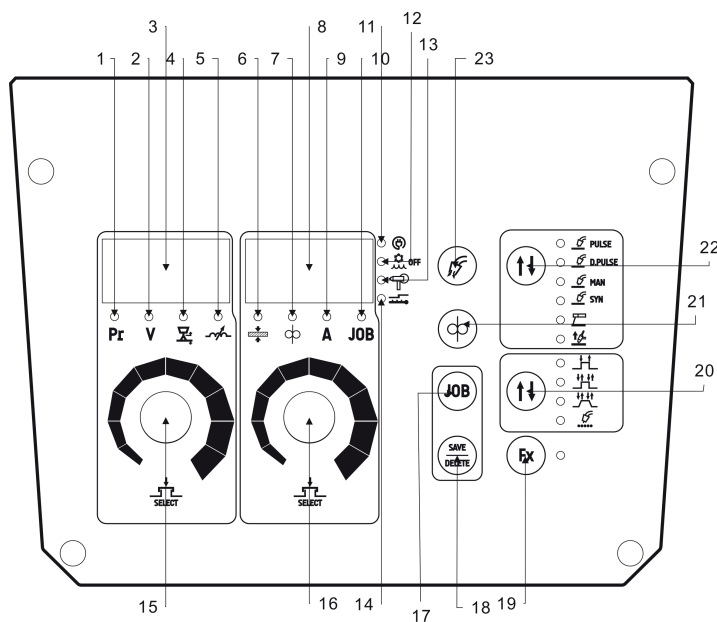
Wire Feeder of welding machine

11. Spool holder.
12. Wire feed tension adjustment (2x).
13. Wire feed tension arm (2x).
14. Wire feeder inlet guide.
15. Drive roller retainer (2x).
16. Wire drive roller (2x).
17. Wire feed motor.



3.2 Control Panel of welding machine

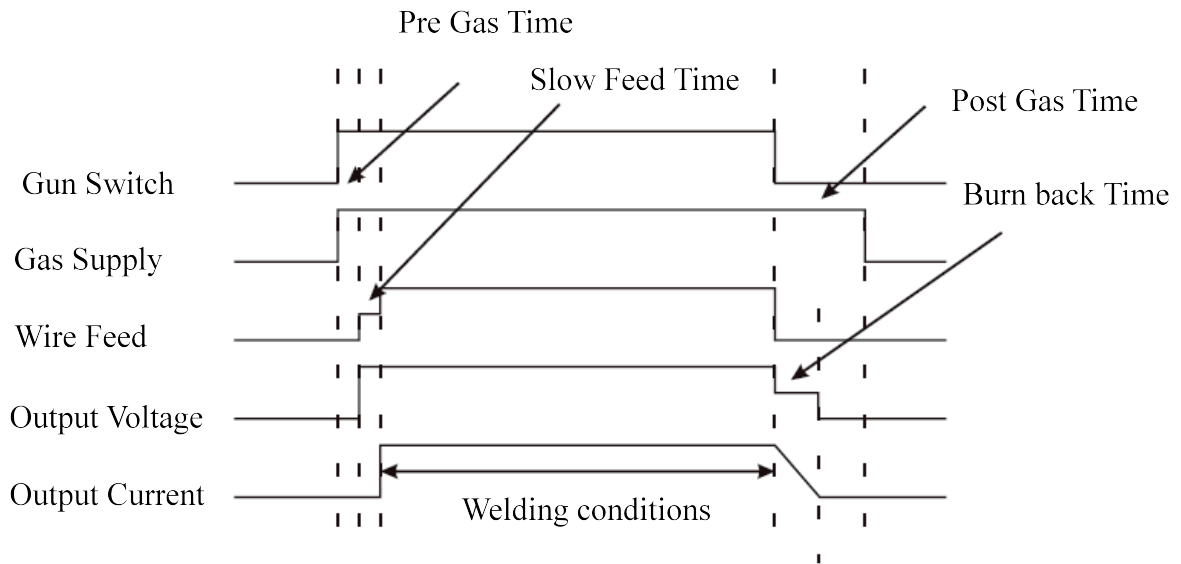
1. Synergic programs indicator.
2. Welding voltage indicator.
3. L digital multifunction display.
4. Arc length indicator.
5. Inductance indicator.
6. Material thickness indicator.
7. Wire feed indicator.
8. R digital multifunction display.
9. Welding current indicator.
10. JOB indicator.
11. Power indicator: Lights when input power connected and machine switched on.
12. Water cooling system error indicator.
13. Spool Gun indicator.
14. Alarm indicator.
15. L parameter select/ adjust knob.
16. R parameter select/ adjust knob.
17. JOB button.
18. Program save/delete button.
19. Function button.
20. Trigger mode select button: Select 2T/4T/S4T/Spot Weld
21. Manual wire button.
22. Welding process select button: Select MIG-MAG Pulse SYN/MIG-MAG dual pulse SYN/MIG-MAG Manual / MIG-MAG SYN/MMA/TIG
23. Air check button.



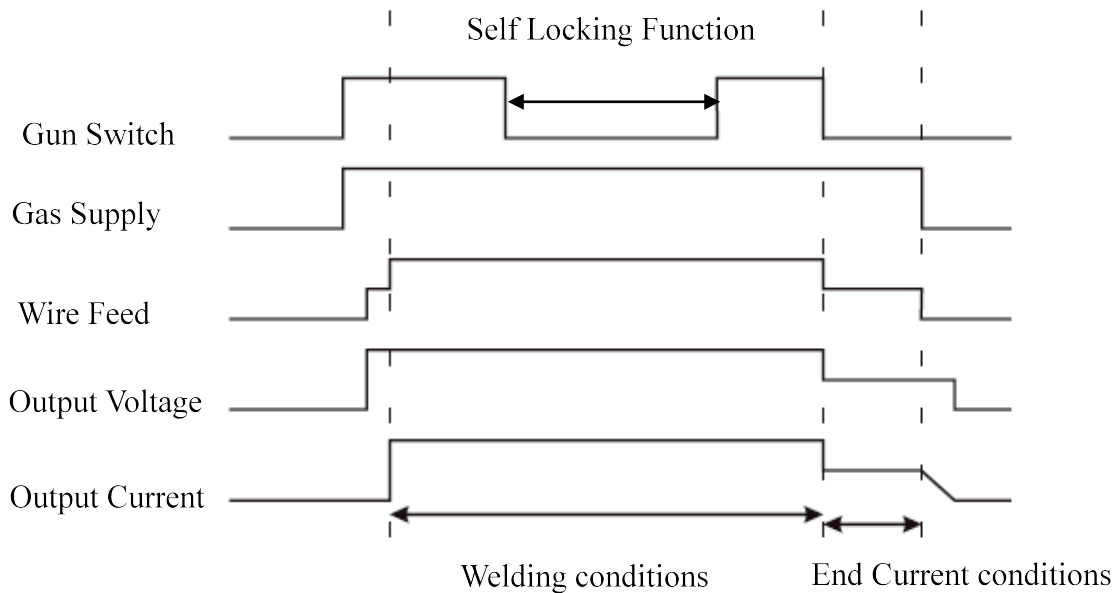
Controls Explained

Trigger mode select button (20)

⏏ 2T mode

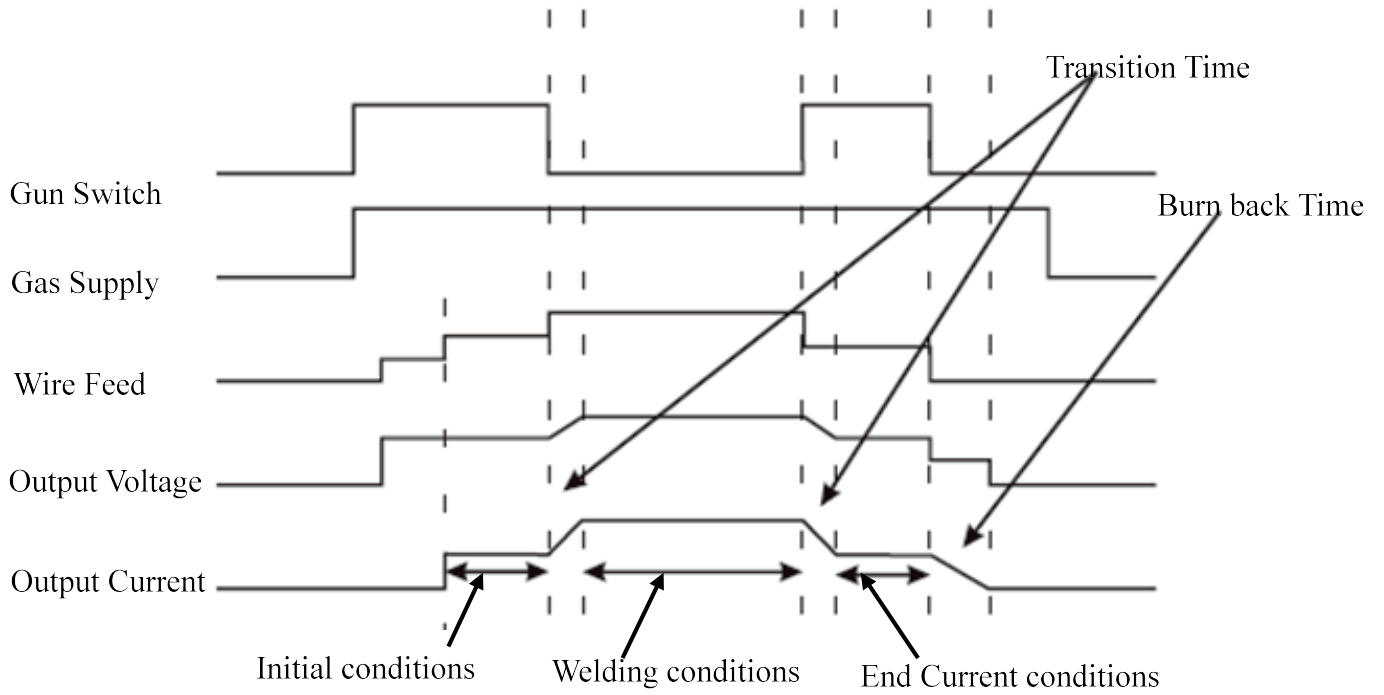


⏏ 4T mode

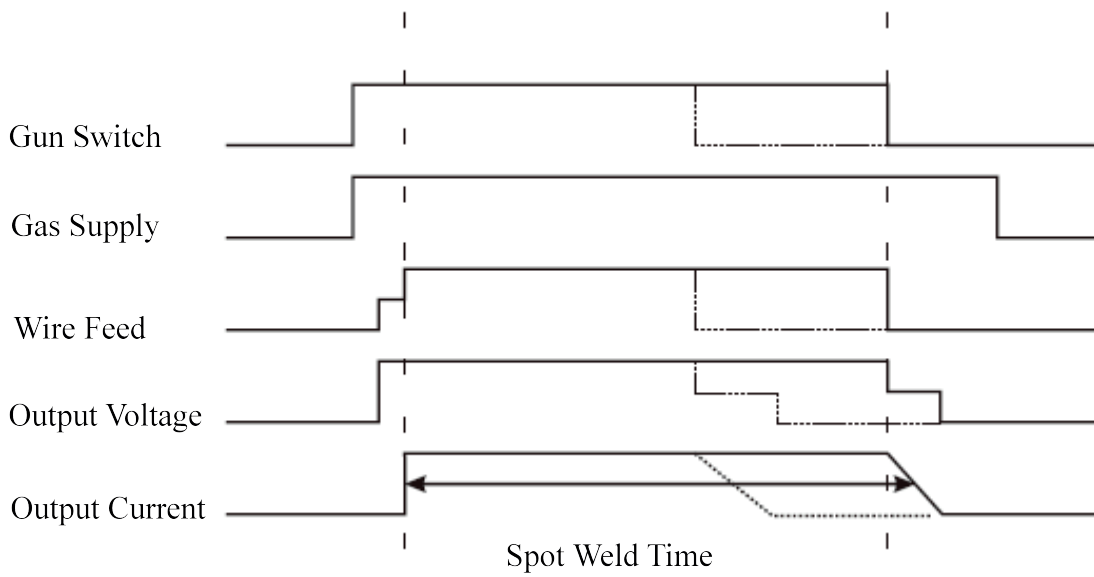




S4T mode



Spot weld



Function button (19)

- **Implicit parameter menu and parameter adjustment method for import and export**

- Press the function button (19), the indicator light that into the implicit function parameter adjusting mode.
- Select the parameter code that needs to be modified by the knob (15), it will show on the digital meter (3); adjust the parameter value by the knob (16), it will show on the digital meter (8).
- Press the function button (19) again, the indicator light is off, exit implicit function parameter adjusting mode.

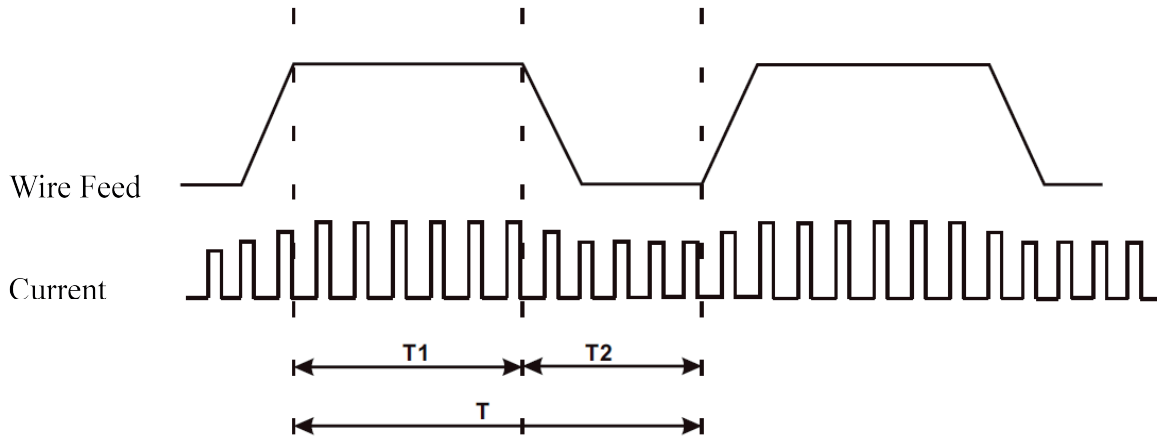
- **Implicit parameter function introduction**

DISPLAY	FUNCTION	ADJUSTABLE RANGE	MODE
PrG	PRE GAS	0-5S	
PoG	POST GAS	0-10S	
SFt	SLOW FEED TIME	0-10S	
bub	BURN BACK	0-10	
SPt	SPOT WELD TIME	0-10S	
dPC	DELTA PULSE CURRENT	0-200A	DUAL PULSE
FdP	DUAL PULSE FREQUENCY	0.5-3.0Hz	
dut	DUAL PULSE DUTY	10-90%	
bAL	DUAL PULSE BASE CURRENT ARC LENGTH	-10-+10	
SCP	START CURRENT PERCENT	1-200%	S4T
SAL	START CURRENT ARC LENGTH	-10-+10	
ECP	END CURRENT PERCENT	1-200%	
EAL	END CURRENT ARC LENGTH	-10-+10	
HdC	HYDROCOOLING	oFF/on	
SPG	SPOOL GUN	oFF/on	
HSt	HOT START	0-10	MMA
ACF	ARC FORCE	0-10	
dSL	DOWN SLOPE	0-10S	TIG

- **Dual pulse function introduction**

Dual pulse welding in single pulse welding with low frequency modulated pulse, low frequency pulse frequency 0.5-3.0Hz. Single pulse compared to dual pulse has the advantages of: without welding swing, weld automatic fish squamous and fish scale pattern density, the depth can be adjusted; to be more precise control of heat input. During the low current, cooling the molten pool, reduce workpiece deformation, reduce the hot cracking tendency;

and periodically stirring molten pool, grain refinement, the hydrogen gas from the molten pool in precipitation to reduce the porosity and reduce welding defects. Dual pulse reference waveform as shown below:



■ DUAL PULSE FREQUENCY

Set low frequency pulse frequency, as shown in Figure regulating the value of time T , namely fish scale pattern of density regulation.

■ DUAL PULSE DUTY

Dual pulse duty set strong pulse group time T_1 and low frequency cycle T ratio, namely the regulation of the proportion of the fish scale pattern in the protruding part and the groove.

JOB button (17)

In the JOB mode, 100 different JOB records can be stored and called, improve the quality of welding process.

Save the JOB programs

Welding machine before leaving the factory did not save the JOB programs, to be called before, you must first save the JOB programs

- Set JOB mode parameters (welding function, welding mode, welding parameters, etc).
- Press the JOB button (17), go in save state.
- Select JOB number by the adjustment Knob (16), it will show on the digital meter (8).

NOTE: the digital meter (3) display "---", the JOB number no JOB programs .

- Press the Save/Delete button (18), save successful.

Call the JOB programs

- Press the JOB button (17) , the JOB LED is on.
- Select the required JOB number by the a djustment Knob (16), it will show on the digital meter (8).
- Press the JOB button (17) again , the JOB LED is off, exit JOB mode.

Alarm indicator (14)

Lights when over voltage, over current, input phase loss or electrical overheating (due to exceeding duty cycle) is detected and protection is activated. When protection is activated, welding output will be disabled until the safety system senses the overload has reduced sufficiently and indicator lamp goes out. May also trigger if machine experiences an internal power circuit failure.

Synergic programs indicator(1)

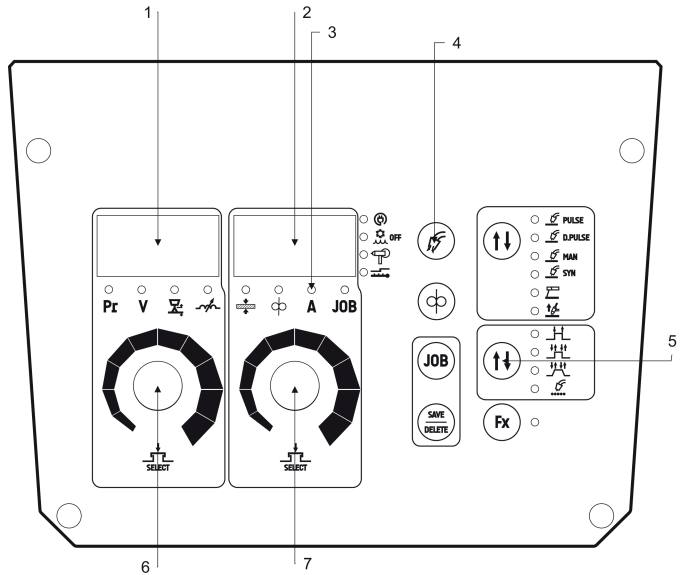
Synergic Function

This makes the setup of MIG welding more simple, the operator simply sets the welding current and the machine calculates the optimal voltage and wire speed for the material type, wire type and size and shielding gas being used. Obviously other variables such as welding joint type and thickness, air temperature affect the optimal voltage and wire feed setting, so the program provides a v oltage fine tuning function for the synergic program selected. Once the voltage is adjusted in a synergic program it will stay fixed at this variation when the current setting is changed. To reset the voltage for a synergic program back to factory default, change to another program and back again.

The synergic programs are given a number from 1 -17, this is accessed on the L display (3) using the L knob (15), indicator 'P'. To select the relevant program for the welding application, check the chart printed on the inside door of the welding machine or further on in this manual.

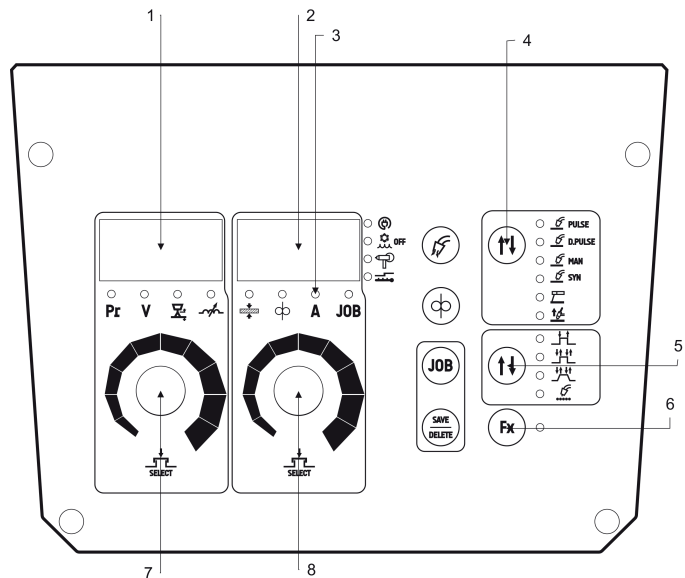
MMA Function - Front Panel Description

1. Hot Start / Arc Force Parameter code Display
2. Welding Current / Hot Start / Arc Force Display
3. Welding Current Indicator
4. MMA Function Select
5. Hot Start / Arc Force Parameter Select
6. Hot Start / Arc Force Parameter code Select
7. Welding Current / Hot Start / Arc Force Set



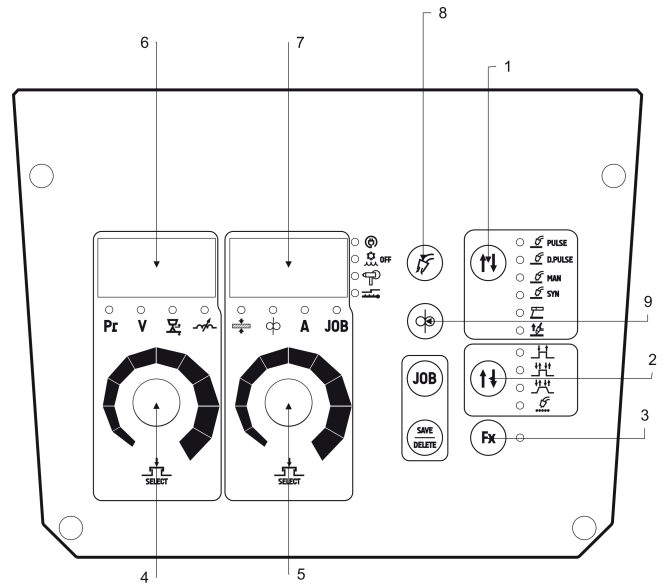
TIG Function - Front Panel Description

1. Down Slope / Hydrocooling code Display
2. Welding Current / Down Slope Time / Hydrocooling (on/off) Display
3. Welding Current Indicator
4. TIG Function Select
5. 2T/4T Trigger Select.
6. Down Slope / Hydrocooling Parameter Select
7. Down Slope / Hydrocooling code Select
8. Welding Current / Down Slope Time / Hydrocooling (on/off) Set



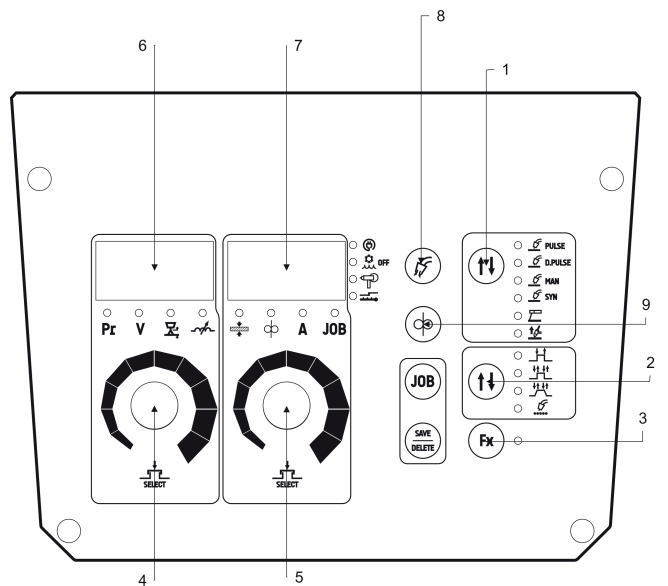
MIG-MAG Pulse SYN Function- Front Panel Description

1. MIG-MAG Pulse SYN Function Select
2. 2T/4T/S4T/Spot Weld Select
3. Function Select, refer to § 4.4
4. Synergic programs numbers select, refer to § 4.4
4. Voltage/ Arc length/ Inductance Set
5. Material thickness /Current/ Wire Speed Set
6. Programs Numbers/Voltage/Arc length/ Inductance Display
7. Current/ Wire Speed / Material Thickness Display
8. Air Check Select
9. Manual Wire Select



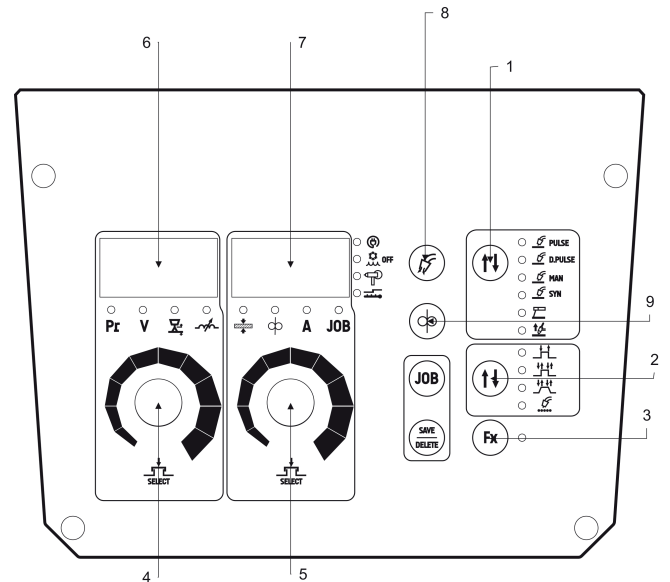
MIG-MAG Dual Pulse SYN Function - Front Panel Description

1. MIG-MAG Dual Pulse SYN Function Select
2. 2T/4T/S4T/Spot Weld Select
3. Function Select, refer to § 4.4
4. Synergic programs numbers select, refer to § 4.4
4. Voltage/ Arc length/ Inductance Set
5. Material thickness /Current/ Wire Speed Set
6. Programs Numbers/ Voltage/ Arc length/ Inductance Display
7. Current/ Wire Speed / Material Thickness Display
8. Air Check Select
9. Manual Wire Select



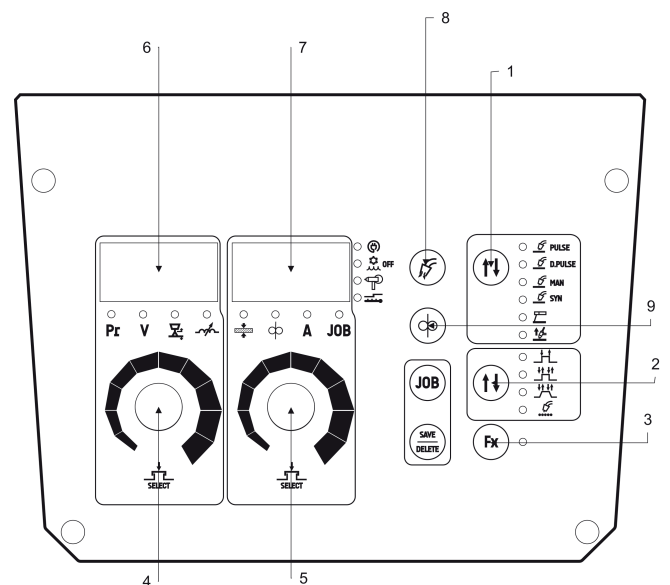
MIG-MAG Manual Function- Front Panel Description

1. MIG-MAG Manual Function Select
2. 2T/4T /Spot Weld Select
3. Function Select, refer to § 4.4
4. Voltage/ Inductance Set
5. Material thickness /Current/ Wire Speed Set
6. Voltage/ Inductance Display
7. Material thickness /Current/ Wire Speed Display
8. Air Check Select
9. Manual Wire Select



MIG-MAG SYN Function-Front Panel Description

1. MIG-MAG SYN Function Select
2. 2T/4T /S4T/Spot Weld Select
3. Function Select, refer to § 4.4
4. Synergic programs numbers select, refer to § 4.4
4. Voltage/ Inductance Set
5. Material thickness /Current/ Wire Speed Set
6. Programs Numbers /Voltage/ Inductance Display
7. Material thickness /Current/ Wire Speed Display
8. Air Check Select
9. Manual Wire Select



4 Installation & Operation

4.1 Installation & Operation for MMA Welding

4.1.1 Set up installation for MMA Welding

(1) Connection of Output Cables.

Connection of Output Cables Two sockets are available on this welding machine. For MMA welding the electrode holder is shown be connected to the positive socket, while the earth lead (work piece) is connected to the negative socket, this is known as DC EP. However various electrodes require a different polarity for optimum results and careful attention should be paid to the polarity, refer to the electrode manufacturers information for the correct polarity.

DCEP: Electrode connected to “+” output socket.

DCEN: Electrode connected to “-” output socket.

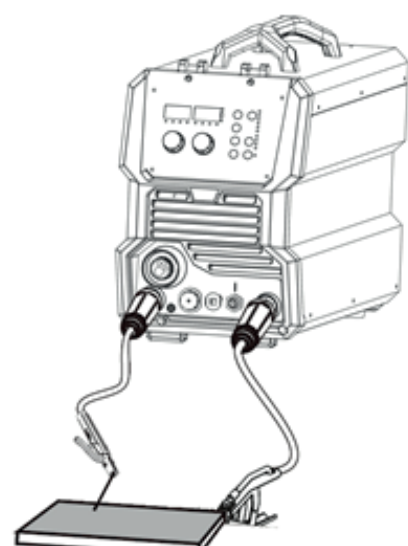
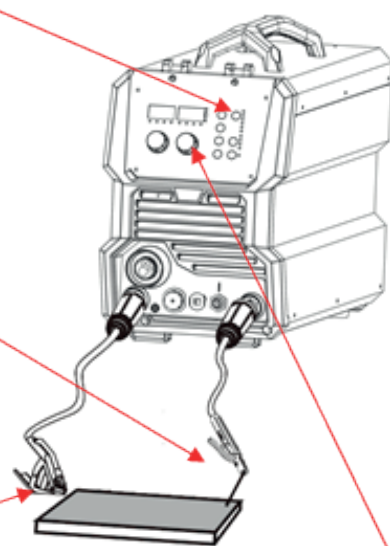
(2) Turn the power source on and press the TIG/MMA/MIG button to select the MMA function.

(3) Set the welding current relevant to the electrode type and size being used as recommended by the electrode manufacturer.

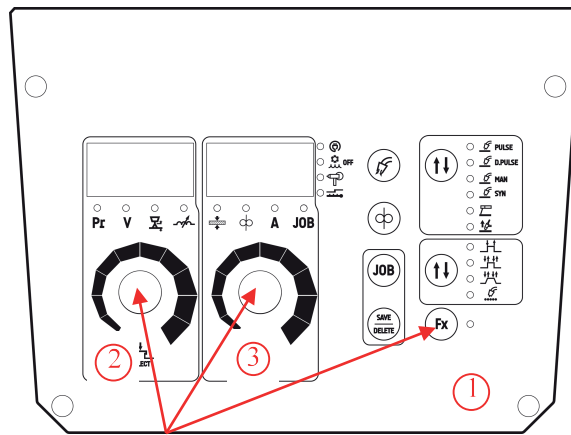
(2) Press the TIG/MMA/MIG button to MMA

(1) Connect the earth lead to “-”

(1) Connect the electrode lead to “+”



(3) Set the welding current using the knob



- (4) Set the Hot Start and Arc Force as required using the button and knobs.
- (5) Place the electrode into the electrode holder and clamp tight.
- (6) Strike the electrode against the work piece to create an arc and hold the electrode steady to maintain the arc.

4.1.2 MMA Welding Fundamentals

Electrode Selection

As a general rule, the selection of an electrode is straight forward, in that it is only a matter of selecting an electrode of similar composition to the parent metal. However, for some metals there is a choice of several electrodes, each of which has particular properties to suit specific classes of work. It is recommended to consult your welding supplier for the correct selection of electrode.

4.2 Installation & Operation for TIG Welding

4.2.1 Set up installation for TIG Welding

- (1) Insert the earth cable plug into the positive socket on the front of the machine and tighten it.
- (2) Plug the welding torch into the negative socket on the front panel, and tighten it.
- (3) Connect the gas line of TIG Gun to outlet gas connector on the front of the machine . **Check for Leaks!**
- (4) Connect the control cable of torch switch to 12 pin socket on the front of the machine .
- (6) Connect the gas regulator to the Gas Cylinder and connect the gas line to the Gas Regulator. **Check for Leaks!**
- (7) Connect the gas line to the machine inlet gas connector located on the rear panel.

Check for Leaks!

- (9) Connect the power cable of welding machine with the output switch in electric box on site.
- (10) Carefully open the valve of the gas cylinder, set the required gas flow rate.
- (11) Select TIG function on the front panel.
- (12) Set torch operation 2T / 4T.
 - When 2T operation is selected press trigger Gas starts, touch and lift arc start, release trigger Gas and Arc stops.
 - **When 4T operation is selected press and release trigger Gas starts, touch and lift arc start, press and release trigger Gas and Arc stops.**

LIFT ARC DC TIG Operation

Lift Arc ignition allows the arc to be started easily in DC TIG by simply touching the tungsten to the work piece and lifting it up to start the arc. This prevents the tungsten tip sticking to the work piece and breaking the tip from the tungsten electrode. There is a particular technique called “rocking the cup” used in the Lift Arc process that provides easy use of the Lift Arc function.

- (13) Select welding current as required on the front panel. The selected welding current will show on the digital meter.
- (14) Set down slope time as required on the front panel. The down slope time will show on the digital meter.
- (15) Assemble front end parts of the TIG torch making sure they are correctly assembled, use the correct size and type of tungsten electrode for the job, the tungsten electrode requires a sharpened point for DC welding.
- (16) Lay the outside edge of the Gas Cup on the work piece with the Tungsten Electrode 1 - 2mm from the work piece. Press and hold the torch switch to activate to gas flow and welding power.
- (17) With a small movement rotate the Gas Cup forward so that the Tungsten Electrode touches the work piece.
- (18) Now rotate the Gas Cup in the reverse direction to lift the Tungsten electrode from the work piece to create the arc.
- (19) Release the trigger to stop the welding.



Assemble front end parts of the TIG torch, fitting a sharpened tungsten suitable for DC welding.



Lay the outside edge of the Gas Cup on the work piece with the tungsten electrode 1-12mm from the work piece. Press and hold the trigger button on TIG torch to start the gas flow.



With a small movement rotate the Gas Cup forward so that the tungsten electrode touches the work piece.



Now rotate the Gas Cup in the reverse direction to lift the tungsten electrode from the work piece to create the arc.

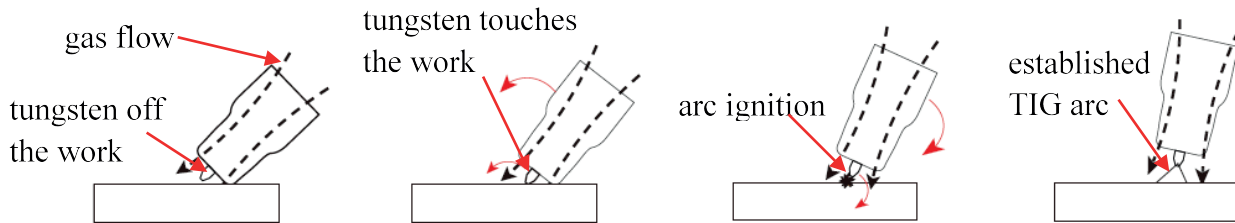


Release the trigger to stop the welding.

IMPORTANT! - We strongly recommend that you check for gas leaks prior to operation of your machine. We recommend that you close the cylinder valve when the machine is not in use.

LIFT ARC IGNITION for TIG (tungsten inert gas) Welding

Lift Arc is a form of arc ignition where the machine has low voltage on the electrode to only a few volts, with a current limit of one or two amps (well below the limit that causes metal to transfer and contamination of the weld or electrode). When the machine detects that the tungsten has left the surface and a spark is present, it immediately (within microseconds) increases power, converting the spark to a full arc. It is a simple, safe lower cost alternative arc ignition process to HF (high frequency) and a superior arc start process to scratch start.



Lay the nozzle on the job without the tungsten touching the work.

Rock the torch sideways so that the tungsten touches the work & hold momentarily.

Rock the torch back in the opposite direction, the arc will ignite as the tungsten lifts off the work.

Lift the torch to maintain the arc.

4.2.2 Tungsten Preparation

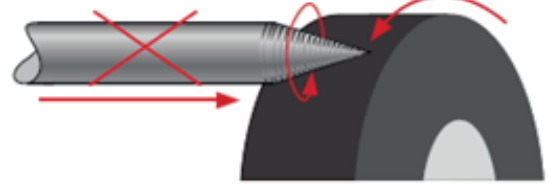
Always use **DIAMOND** wheels when grinding and cutting. While tungsten is a very hard material, the surface of a diamond wheel is harder, and this makes for smooth grinding. Grinding without diamond wheels, such as aluminium oxide wheels, can lead to jagged edges, imperfections, or poor surface finishes not visible to the eye that will contribute to weld inconsistency and weld defects.

Always ensure to grind the tungsten in a longitudinal direction on the grinding wheel. Tungsten electrodes are manufactured with the molecular structure of the grain running lengthwise and thus grinding crosswise is “grinding against the grain”. If electrodes are ground crosswise, the electrons have to jump across the grinding marks and the arc can start before the tip and wander. Grinding longitudinally with the grain, the electrons flow steadily and easily to the end of the tungsten tip. The arc starts straight and remains narrow, concentrated, and stable.

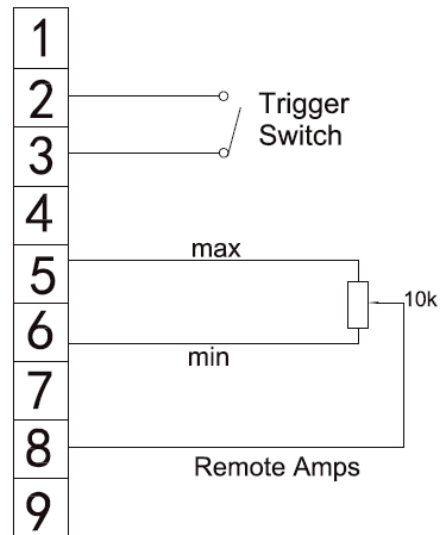
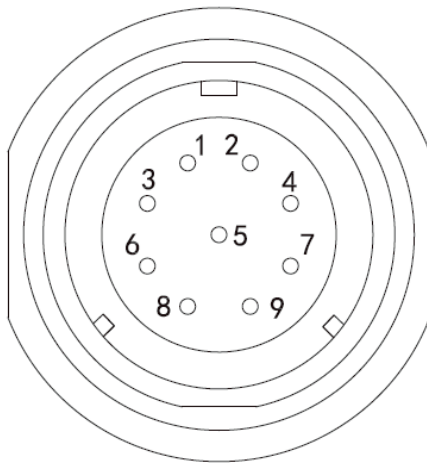
grind longitudinal on the grinding wheel



don't grind across the grinding wheel



4.2.3 Gun switch control current



Remote Control Socket

Socket Pin	Function
1	Not connected
2	Trigger Switch Input
3	Trigger Switch Input
4	Not connected
5	10k ohm (maximum) connection to 10k ohm remote control potentiometer
6	Zero ohm (minimum) connection to 10k ohm remote control potentiometer
7	Not connected
8	Wiper arm connection to 10k ohm remote control potentiometer
9	Not connected

4.3 Installation & Operation for MIG Welding

4.3.1 Set up installation for MIG Welding- Gas shielded wire

(1) Insert the earth cable plug into the negative socket on the front of the machine and tighten it.

(2) Plug the welding torch into the MIG torch connection socket on the front panel and tighten it.

IMPORTANT : When connecting the torch be sure to tighten the connection. A loose connection can result in the connector arcing and damaging the machine and gun connector.

(4) Connect the MIG power connection lead to the positive welding power output socket.

Note if this connection is not made, there will be no electrical connection to the welding torch!

(5) Connect the gas regulator to the Gas Cylinder and connect the gas line to the Gas Regulator.

Check for Leaks!

(6) Connect the power cable of welding machine with the output switch in electric box on site.

(7) Place the Wire Spool onto the Spool Holder. Snip the wire from the spool being sure to hold the wire to prevent rapid uncoiling. Feed the wire into the wire feeder inlet guide tube through to the drive roller.

(8) Carefully feed the wire over the drive roller into the outlet guide tube, feed through about 150mm into the torch receptacle. Check that the drive roller size is compatible with the wire diameter, replace the roller if necessary.

(9) Align the wire into the groove of the drive roller and close down the top roller making sure the wire is in the groove of the bottom drive roller, lock the pressure arm into place. Apply a medium amount of pressure to the drive roller.

(10) Remove the gas nozzle and contact tip from the torch neck.

(11) Press and hold the manual wire button to feed the wire through to the torch neck, release the manual wire key when the wire exits the torch neck.

(12) Fit the correct sized contact tip and feed the wire through it, screw the contact tip into the tip holder of the torch head and nip it up tightly.

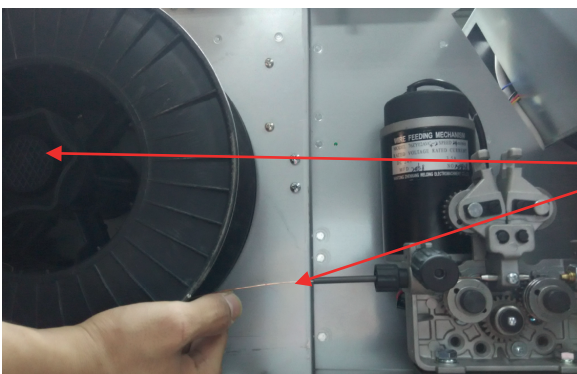
(13) Fit the gas nozzle to the torch head.

(14) Carefully open the gas cylinder valve and set the required gas flow rate.

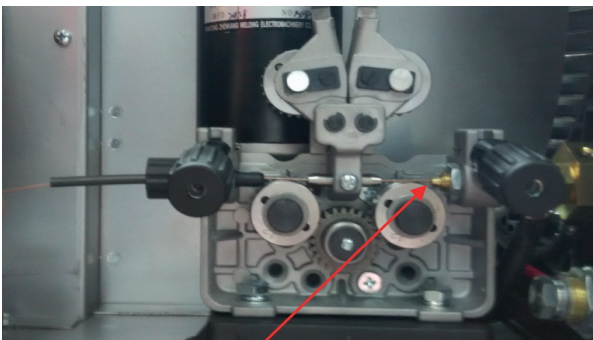
(15) Select 2T/4T/S4T/Spot Weld trigger function.

(16) Select the required MIG-MAG function, Select program number to suit the wire diameter and gas type being used, it will show on the digital meter.

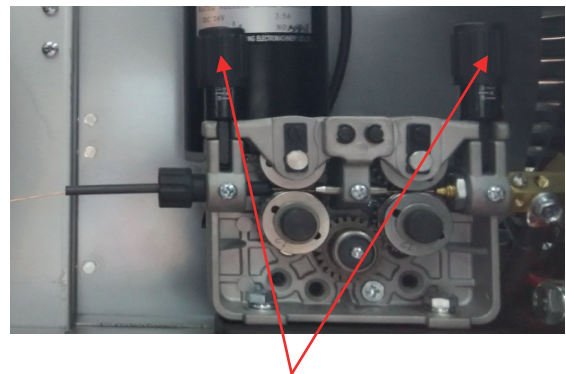
(17) Set the required welding parameters to suit the material thickness being welded, it will show on the digital meter.



Place wire onto spool holder (spool retaining nut is left hand thread). Feed the wire through the inlet guide tube on to the drive roller.



(8) Feed wire over the drive roller into the outlet guide tube, push the wire through approx 150mm.



(9) Close down the top roller bracket and clip the pressure arm into place with a medium amount of pressure applied.

4.3.2 Wire Feed Roller Selection

The importance of smooth consistent wire feeding during MIG welding cannot be emphasized enough. Simply put the smoother the wire feed then the better the welding will be.

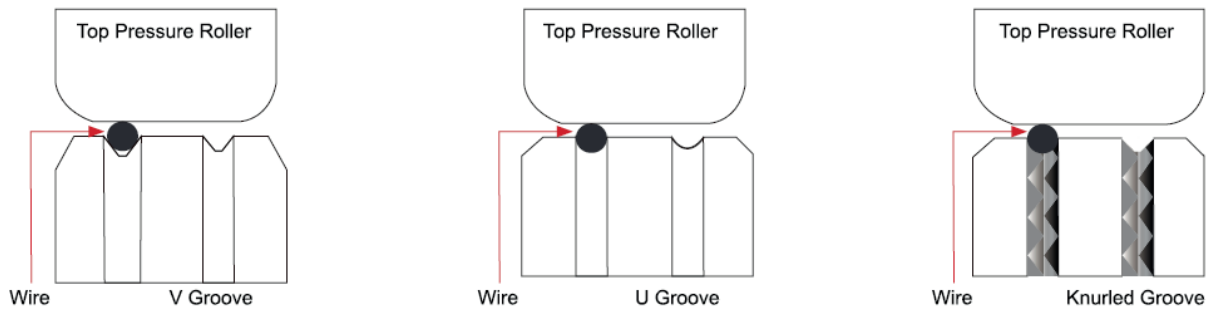
Feed rollers or drive rollers are used to feed the wire mechanically along the length of the welding gun. Feed rollers are designed to be used for certain types of welding wire and they have different types of grooves machined in them to accommodate the different types of wire. The wire is held in the groove by the top roller of the wire drive unit and is referred to as the pressure roller, pressure is applied by a tension arm that can be adjusted to increase or decrease the pressure as required. The type of wire will determine how much pressure can be applied and what type of drive roller is best suited to obtain optimum wire feed.

Solid Hard Wire- like Steel, Stainless Steel require a drive roller with a V shape groove for optimum grip and drive capability. Solid wires can have more tension applied to the wire from the top pressure roller that holds the wire in the groove and the V shape groove is more suited for this. Solid wires are more forgiving to feed due to their higher cross sectional column strength, they are stiffer and don't bend so easy.

Soft Wire - like Aluminium requires a U shape groove. Aluminium wire has a lot less column strength, can bend easily and is therefore more difficult to feed. Soft wires can easily buckle at the wire feeder where the wire is fed into inlet guide tube of the torch. The U-shaped roller offers more surface area grip and traction to help feed the softer wire. Softer wires also require less tension from the top pressure roller to avoid deforming the shape of the wire, too much tension will push the wire out of shape and cause it to catch in the contact tip.

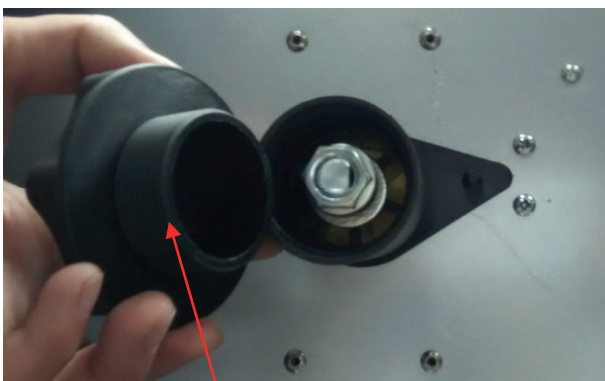
Flux Core / Gasless Wire - these wires are made up of a thin metal sheath that has flux and metal compounds layered onto it and then rolled into a cylinder to form the finished wire. The wire cannot take too much pressure from the top roller as it can be crushed and deformed if too much pressure is applied. A knurled drive roller has been developed and it has small serrations in the groove, the serrations grip the wire and assist to drive it without too much pressure from the top roller. The downside to the knurled wire feed roller on flux cored wire is it will slowly over time bit by bit eat away at the surface of the welding wire, and these small pieces will eventually go down into the liner. This will cause clogging in the liner and added friction that will lead to welding wire feed problems.

A U groove wire can also be used for flux core wire without the wire particles coming of the wire surface. However it is considered that the knurled roller will give a more positive feed of flux core wire without any deformation of the wire shape.

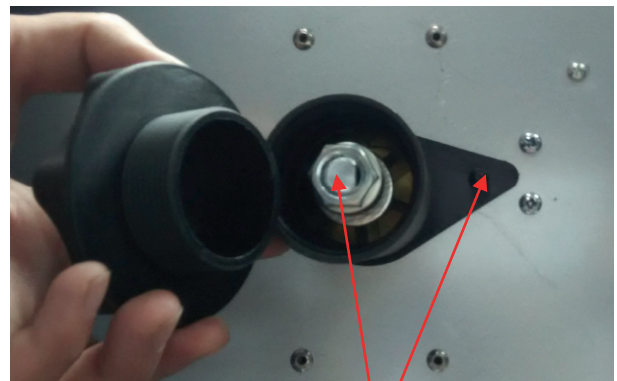


4.3.3 Wire Installation and Set Up Guide

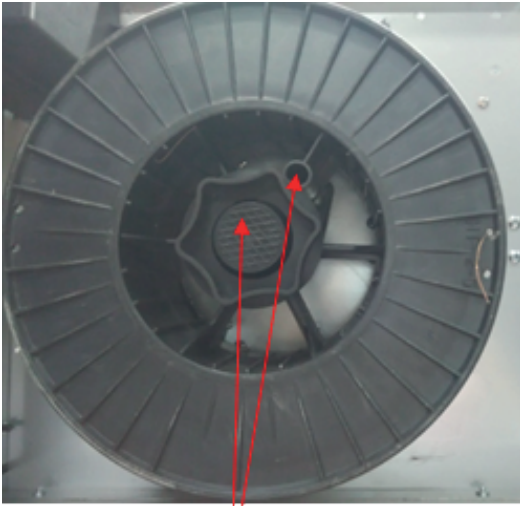
Again the importance of smooth consistent wire feeding during MIG welding cannot be emphasized enough. The correct installation of the wire spool and the wire into the wire feed unit is critical to achieving an even and consistent wire feed. A high percentage of faults with mig welders emanate from poor set up of the wire into the wire feeder. The guide below will assist in the correct setup of your wire feeder.



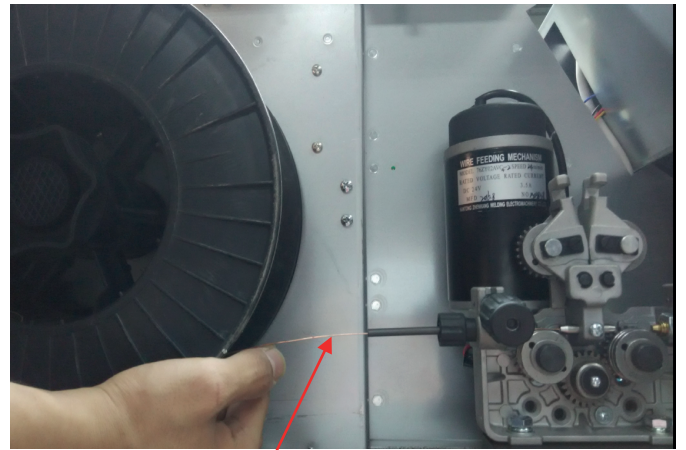
(1) Remove the spool retaining nut.



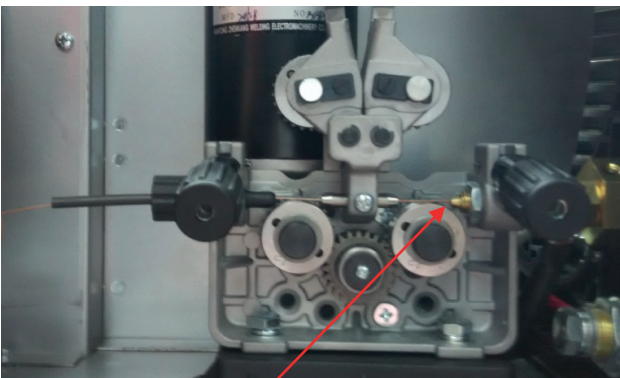
(2) Note the tension spring adjuster and spool locating pin.



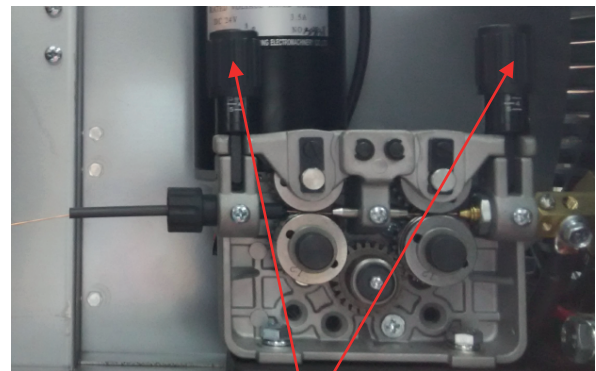
(3) Fit the wire spool onto the spool holder fitting the locating pin into the location hole on the spool. Replace the spool retaining nut tightly.



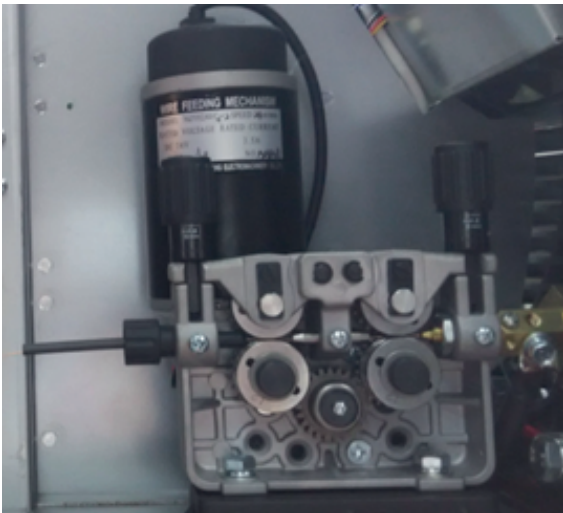
(4) Snip the wire carefully, be sure to hold the wire to prevent the spool uncoiling. Carefully feed the wire into the inlet guide tube of the wire feed unit.



(5) Feed the wire through the drive roller and into the outlet guide tube of the wire feeder.



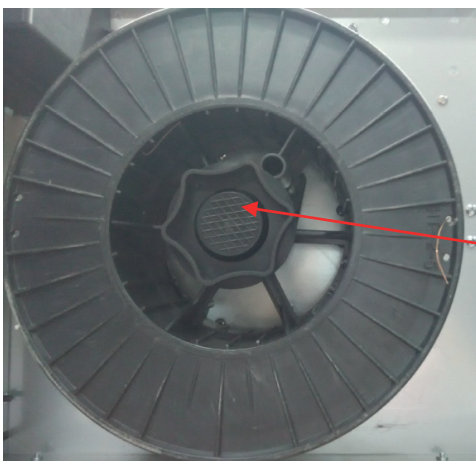
(6) Lock down the top pressure roller and apply a medium amount of pressure using the tension adjustment knob.



(7) Check that the wire passes through the centre of the outlet guide tube without touching the sides. Loosen the locking screw and then loosen the outlet guide tube retaining nut too make adjustment if required. Carefully retighten the locking nut and screw to hold the new position.



(8) A simple check for the correct drive tension is to bend the end of the wire over hold it about 100mm from your hand and let it run into your hand, it should coil round in your hand without stopping and slipping at the drive rollers, increase the tension if it slips.



(9) The weight and speed of the wire spool turning creates an inertia that can cause the spool to run on and the wire loop over the side of the spool and tangle. if this happens increase the pressure on the tension spring inside the spool holder assembly using the tension adjustment screw.

4.3.4 Set up installation for MIG Welding- Gasless wire

(1) Insert the earth cable plug into the positive socket on the front of the machine and tighten it.

(2) Plug the welding torch into the MIG torch connection socket on the front panel and tighten it.

IMPORTANT : When connecting the torch be sure to tighten the connection. A loose connection can result in the connector arcing and damaging the machine and gun connector.

(4) Connect the MIG power connection lead to the negative welding power output socket.

Note if this connection is not made, there will be no electrical connection to the welding torch!

(6) Connect the power cable of welding machine with the output switch in electric box on site.

(7) Fit the correct size Knurled drive roller for Gas Less Flux Core wire.

(8) Place the Wire Spool onto the Spool Holder. Snip the wire from the spool being sure to hold the wire to prevent rapid uncoiling. Feed the wire into the wire feeder inlet guide tube through to the drive roller.

(9) Carefully feed the wire over the drive roller into the outlet guidetube, feed through about 150mm into the torch receptacle. Check that the drive roller size is compatible with the wire diameter, replace the roller if necessary.

(10) Carefully feed the wire over the drive roller into the outlet guide tube, feed through about 150mm into the torch receptacle. Check that the correct drive roller is being used.

(11) Align the wire into the groove of the drive roller and close down the top roller making sure the wire is in the groove of the bottom drive roller, lock the pressure arm into place.

(12) Apply a light amount of pressure to the drive roller. Too much pressure will crush the cored wire.

(13) Remove the gas nozzle and contact tip from the torch neck.

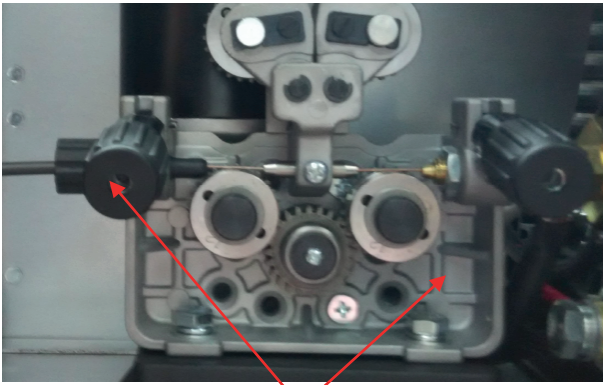
(14) Press and hold the manual wire button to feed the wire through to the torch neck, release the inch button when the wire exits the torch neck.

(15) Fit the correct sized contact tip and feed the wire through it, screw the contact tip into the tip holder of the torch head and nip it up tightly.

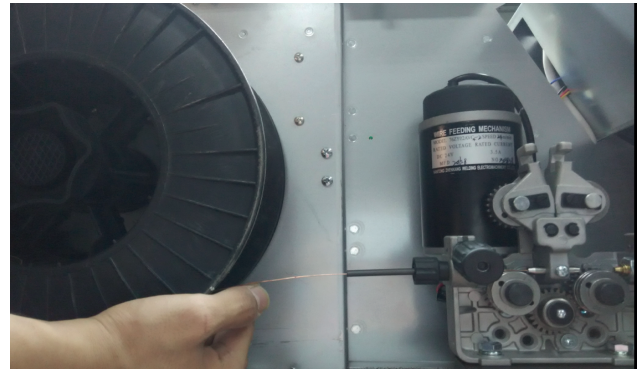
(16) Fit the nozzle to the torch head.

(17) Select MIG on the front panel.

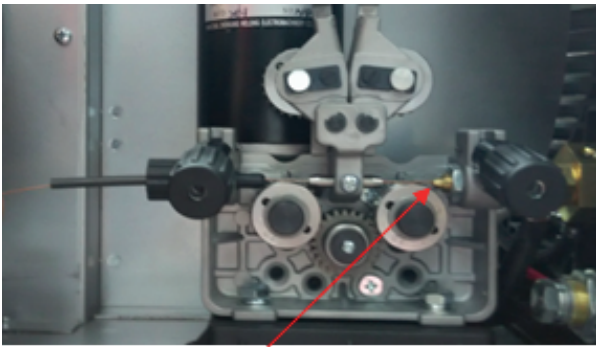
(18) Set the welding parameters using the control knobs.



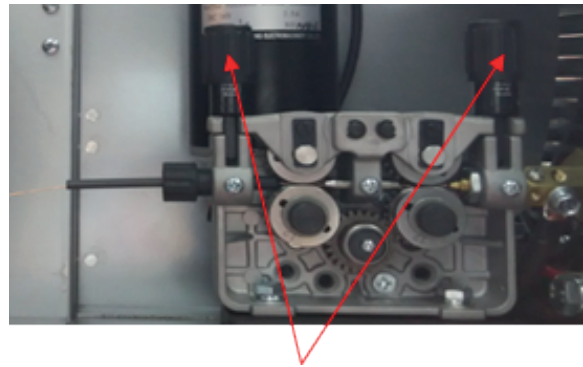
(7) Fit the correct sized Knurled Drive roller for Gas Less Flux Cored wire.



(8) Place wire onto spool holder. Feed the wire through the inlet guide tube on to the drive roller.



(9) Feed wire over the drive roller into the outlet guide tube, Push the wire through approx 150mm. Use a Knurled Drive Roller of the correct size.

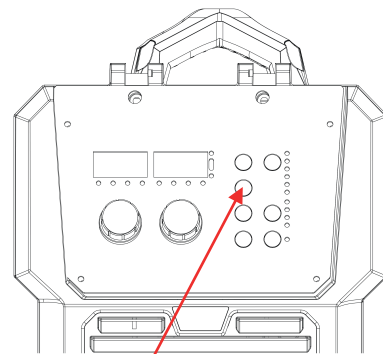


(11) Close down the top roller bracket and clip the pressure arm into place.

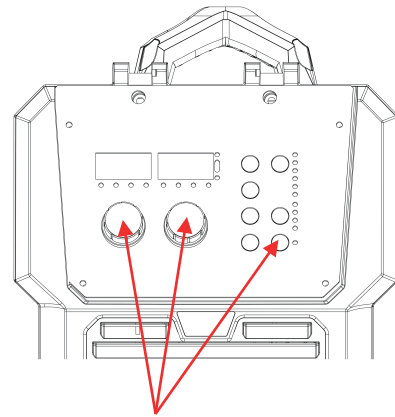
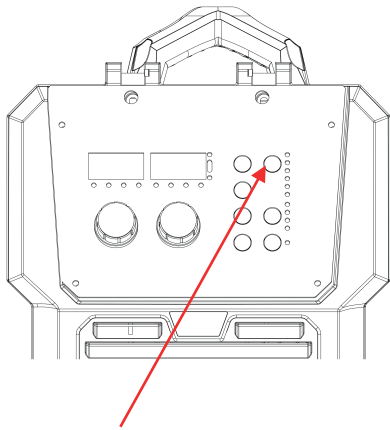
(12) Apply a light amount of pressure to the drive roller.



(13) Remove the gas nozzle and contact tip from the front end of the mig torch.



(14) Press and hold the inch wire button to feed the wire down the torch cable through to the torch head.



- (17) Select your preferred MIG-MAG function. (18) Select the required welding parameters using the knobs.

4.3.5 MIG Torch Liner Installation

- (1) Lay the torch out straight on the ground and remove the front end parts.
- (2) Remove the liner retaining nut.
- (3) Carefully pull the liner out of the torch cable assembly.
- (4) Select the correct new liner and carefully unravel avoiding putting any kinks in the liner, if you kink the liner it will make it no good and will require replacement.
- (5) Carefully and slowly feed the liner in short forward movements down the cable assembly all the way through and out the torch neck end. Avoid kinking the liner, kinking liner it will make it no good and require replacement.
- (6) Fit the liner retaining nut and screw down only 1/2 way.
- (7) Leaving the torch straight snip the liner approximately 3mm past the end of the torch neck.
- (8) Place the tip holder over the end of the liner and screw into the torch neck nipping it up tight.
- (9) Screw down the liner nut the remaining 1/2 and nip it up tight. This method compresses the liner inside the torch cable assembly preventing it moving during use and ensures good wire feed.

4.3.6 MIG Torch Liner Types and Information

MIG Torch Liners

The liner is both one of the simplest and most important components of a MIG gun. Its sole purpose is to guide the welding wire from the wire feeder, through the gun cable and up to the contact tip.

Steel Liners

Most MIG gun liners are made from coiled steel wire also known as piano wire, which provides the liner with good rigidity and flexibility and allows it to guide the welding wire smoothly through the welding cable as it bends and flex during operational use. Steel liners are primarily used for feeding of solid steel wires, other wires such as Aluminium, Silicon Bronze etc will perform better using a teflon or Polyamide line. The internal diameter of the liner is important and relative to the wire diameter being used and will assist in smooth feeding and prevention of the wire kinking and birdnesting at the drive rollers. Also bending the cable too tightly during welding increases the friction between the liner and the welding wire making it more difficult to push the wire through the liner resulting in poor wire feeding, premature liner wear and birdnesting. Dust, grime and metal particles can accumulate inside the liner over time and cause friction and blockages, it is recommended to periodically blow out the liner with compressed air. Small diameter welding wires, 0.6mm through 1.0mm have relatively low columnar strength, and if matched with an oversized liner, can cause the wire to wander or drift within the liner. This in turn leads to poor wire feeding and premature liner failure due to excessive wear. By contrast, larger diameter welding wires, 1.2mm through 2.4mm have much higher columnar strength but it is important to make sure the liner has enough internal diameter clearance. Most manufacturers will produce liners sized to match wire diameters and length of welding torch cable and most are colour coded to suit.

4.3.7 Set up installation for Spool Gun

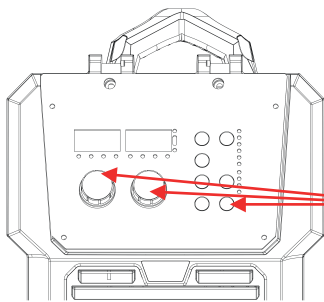
- (1) Insert the earth cable plug into the negative socket on the front of the machine and tighten it.
- (2) Connect the Spool Gun to the Mig torch connection socket on the front panel of the wire feeder, and tighten it.

IMPORTANT : When connecting the torch be sure to tighten the connection. A loose connection can result in the connector arcing and damaging the machine and gun connector.

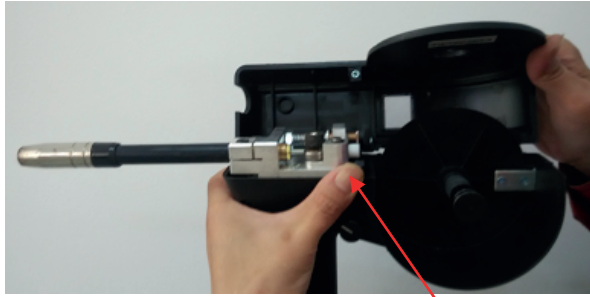
- (3) Connect the Spool Gun control cable to the multipin receptacle on the front panel.
- (4) Connect the MIG power connection lead to the positive welding power output socket.
- (5) Connect the gas regulator to the Gas Cylinder and connect the gas line to the Gas Regulator.

Check for Leaks!

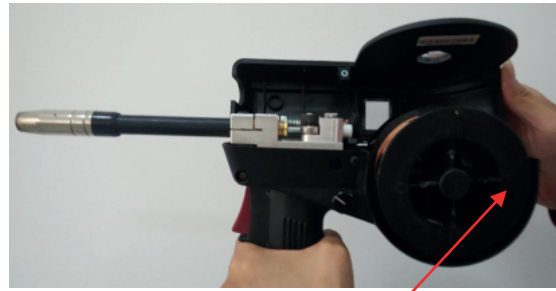
- (6) Connect the gas line to gas connector on the rear panel. **Check for Leaks!**
- (7) Connect the power cable of welding machine with the output switch in electric box on sit.
- (8) Select Spool Gun using the function button and adjustment knobs.
- (9) Take the Spool Gun and remove the spool cover .
- (10) Place the Wire Spool onto the Spool Holder - Hold and snip the wire from the spool being sure to hold the wire to prevent rapid uncoiling.
- (11) Carefully feed the wire through the drive roller into the inlet guide tube. Swing back and clip down the wire tension swing arm.
- (12) Pull the trigger to drive the wire through the neck until it exits the contact tip holder.
- (13) Close the wire feed housing cover, ready for welding.
- (14) Carefully open the gas cylinder valve and set the required gas flow rate.
- (15) Set the welding parameters using the knobs.



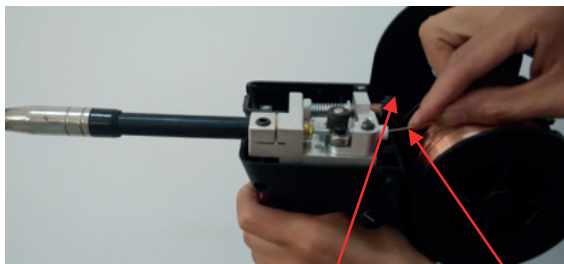
(8) Select Spool Gun using the function key and adjustment knobs



(9) Remove the spool cover when press the button and lifting off the cover.



(10) Place a spool of wire onto the spool holder.



(11) Feed the wire through the drive roller into the inlet guide tube. Swing back and clip down the wire tension swing arm.



(12) Pull the trigger to drive the wire through the neck until it exits the contact tip holder.

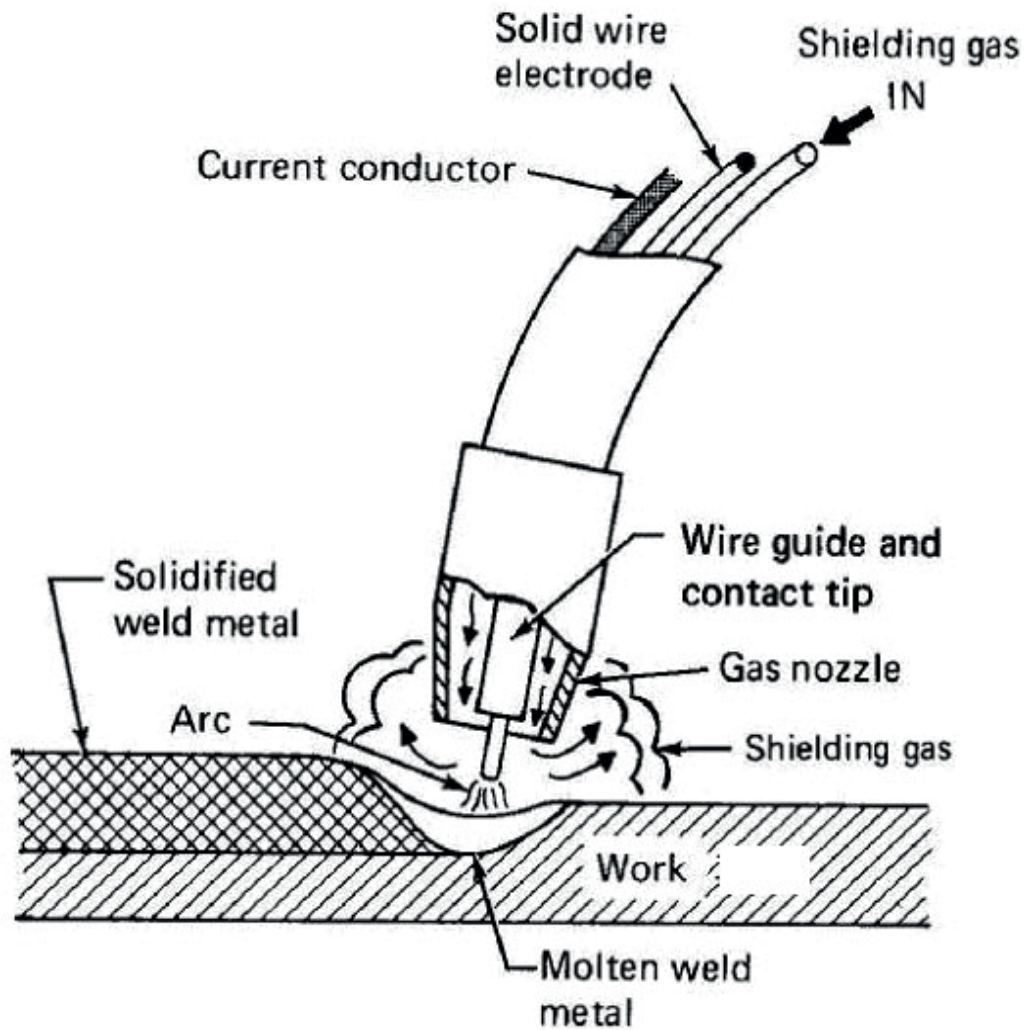
4.3.8 MIG Welding

Definition of MIG Welding

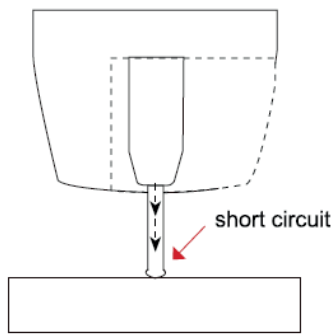
MIG (metal inert gas) welding also known as GMAW (gas metal arc welding) or MAG (metal active gas welding), is a semi - automatic or automatic arc welding process in which a continuous and consumable wire electrode and a shielding gas are fed through a welding gun. A constant voltage, direct current power source is most commonly used with MIG welding. There are four primary methods of metal transfer in MIG welding, called short circuit (also known as dip transfer) globular transfer, spray transfer and pulsed - spray, each of which has distinct properties and corresponding advantages and limitations. To perform MIG welding, the basic necessary equipment is a welding gun, a wire feed unit, a welding power supply, an electrode wire, and a shielding gas supply. Short circuit transfer is the most common used method whereby the wire electrode is fed continuously down the welding torch through to and exiting the contact tip.

The wire touches the work piece and causes a short circuit the wire heats up and begins to form a molten bead, the bead separates from the end of the wire and forms a droplet that is transferred into the weld pool. This process is repeated about 100 times per second, making the arc appear constant to the human eye.

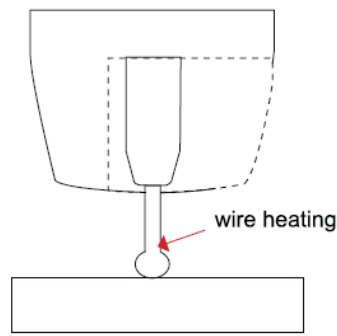
Principles of welding



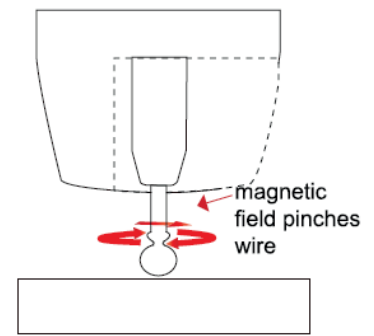
Short Circuit Transfer - Short circuit transfer is the most common used method whereby the wire electrode is fed continuously down the welding torch through to and exiting the contact tip. The wire touches the work piece and causes a short circuit the wire heats up and begins to form a molten bead, the bead separates from the end of the wire and forms a droplet that is transferred into the weld pool. This process is repeated about 100 times per second, making the arc appear constant to the human eye.



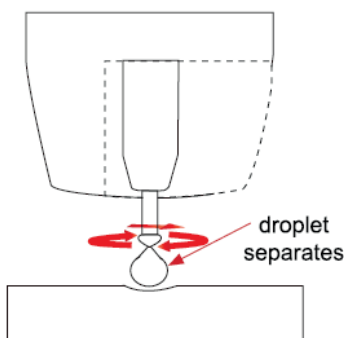
The wire approaches the work piece and touches the work creating a short circuit between the wire and the base metal, because there is no space between the wire and the base metal there is no arc and current flows through the wire.



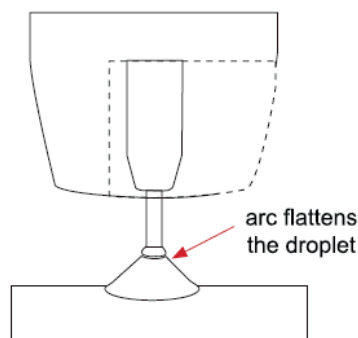
The wire cannot support all the current flow, resistance builds up and the wire becomes hot and weak and begins to melt.



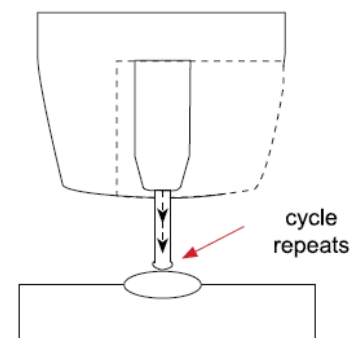
The current flow creates a magnetic field that begins to pinch the melting wire forming it into droplet.



The pinch causes the forming droplet to separate and fall towards the now creating weld pool.



An arc is created at the separation of the droplet and the heat and force of the arc flattens out the droplet into the weld pool. The heat of the arc melts the end of the wire slightly as it feeds towards the base metal.



The wire feed speed overcomes the heat of the arc and the wire again approaches the work to short circuit and repeat the cycle.

Basic MIG Welding

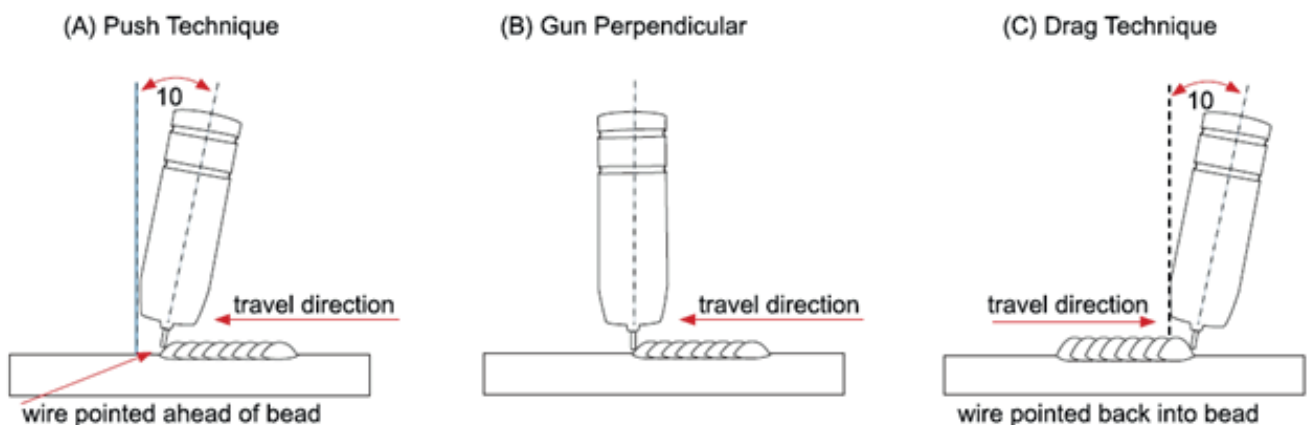
Good weld quality and weld profile depends on gun angle, direction of travel, electrode extension (stick out), travel speed, thickness of base metal, wire feed speed and arc voltage. To follow are some basic guides to assist with your set up.

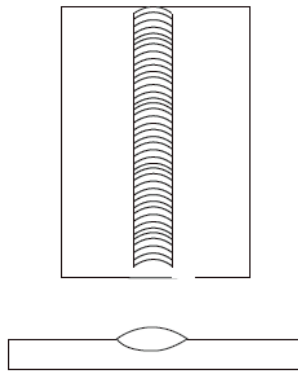
Gun Position - Travel Direction, Work Angle Gun position or technique usually refers to how the wire is directed at the base metal, the angle and travel direction chosen. Travel speed and work angle will determine the characteristic of the weld bead profile and degree of weld penetration

Push Technique - The wire is located at the leading edge of the weld pool and pushed towards the un-melted work surface. This technique offers a better view of the weld joint and direction of the wire into the weld joint. Push technique directs the heat away from the weld puddle allowing faster travel speeds providing a flatter weld profile with light penetration - useful for welding thin materials. The welds are wider and flatter allowing for minimal clean up / grinding time.

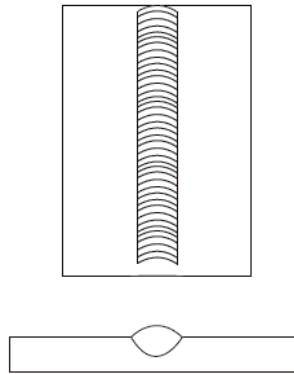
Perpendicular Technique- The wire is fed directly into the weld, this technique is used primarily for automated situations or when conditions make it necessary. The weld profile is generally higher and a deeper penetration is achieved.

Drag Technique - The gun and wire is dragged away from the weld bead. The arc and heat is concentrated on the weld pool, the base metal receives more heat, deeper melting, more penetration and the weld profile is higher with more build up.

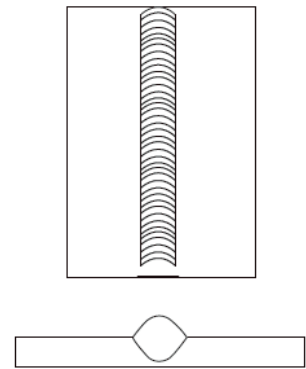




flat even weld profile
light penetration

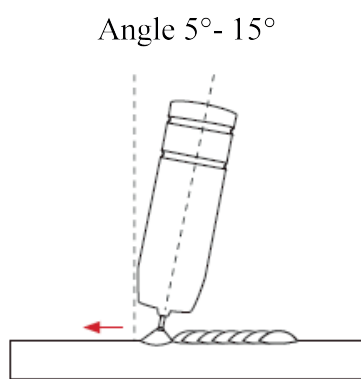


narrower weld profile
even penetration

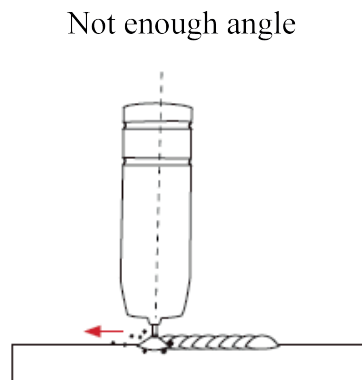


narrow weld profile
higher penetration

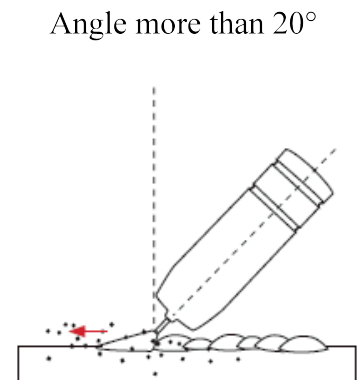
Travel Angle - Travel angle is the right to left angle relative to the direction of welding. A travel angle of 5° - 15° is ideal and produces a good level of control over the weld pool. A travel angle greater than 20° will give an unstable arc condition with poor weld metal transfer, less penetration, high levels of spatter, poor gas shield and poor quality finished weld.



good level of control
over the weld pool,
even flat weld.

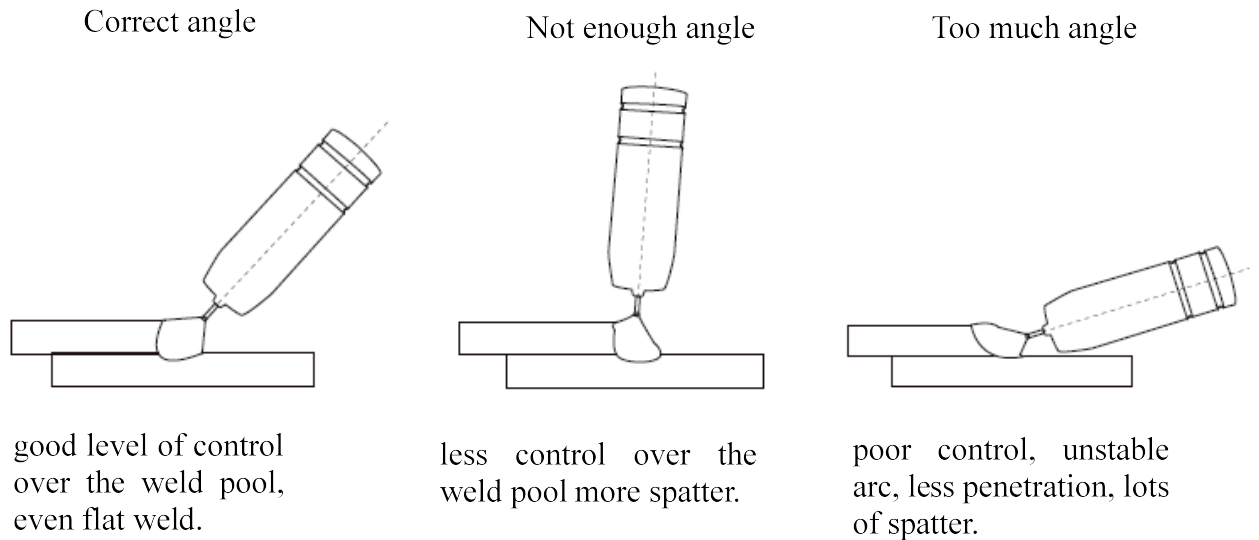


less control over the
weld pool more spatter.

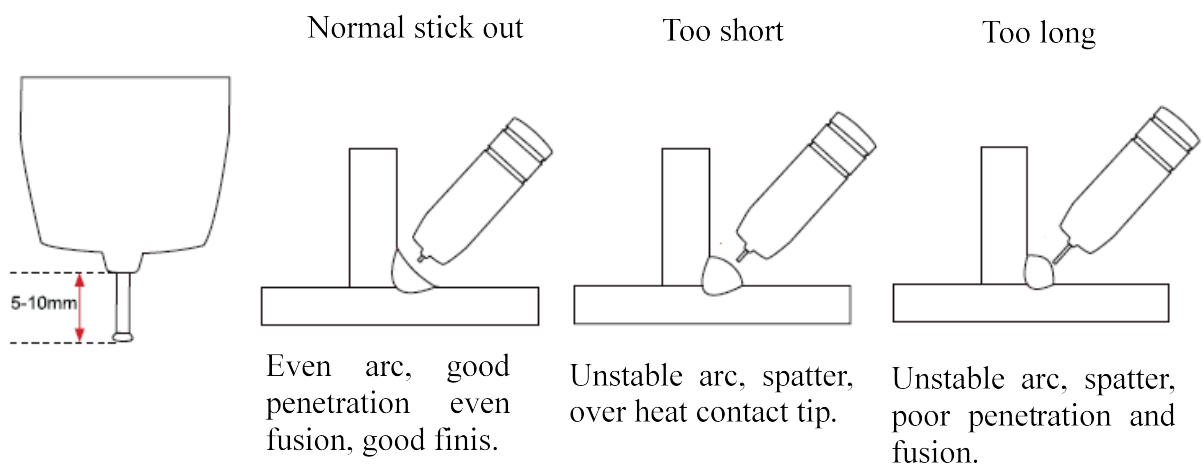


poor control, unstable
arc, less penetration, lots
of spatter.

Angle to Work - The work angle is the forward back angle of the gun relative to the work piece. The correct work angle provides good bead shape, prevents undercut, uneven penetration, poor gas shield and poor quality finished weld.

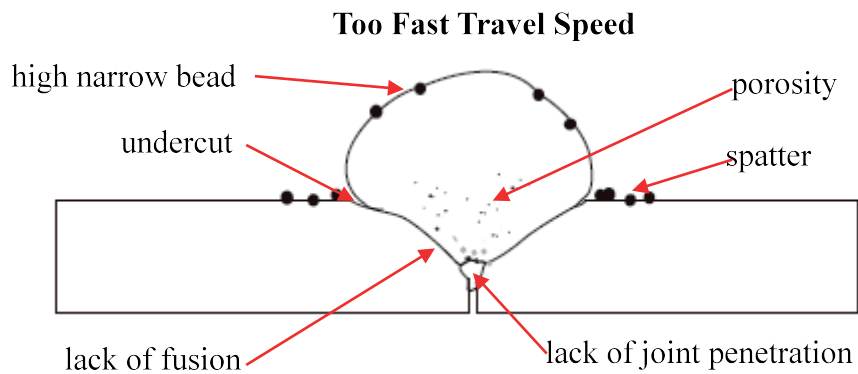


Stick Out- Stick out is the length of the unmelted wire protruding from the end of the contact tip. A constant even stick out of 5-10mm will produce a stable arc, and an even current flow providing good penetration and even fusion. Too short stick out will cause an unstable weld pool, produce spatter and over heat the contact tip. Too long stick out will cause an unstable arc, lack of penetration, lack of fusion and increase spatter.

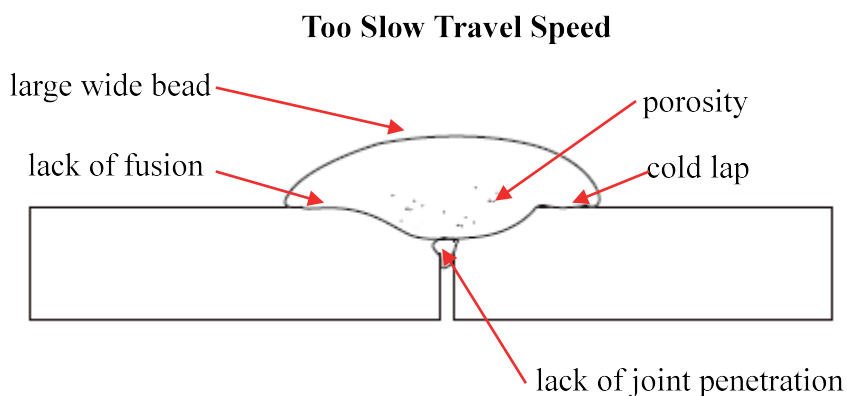


Travel Speed - Travel speed is the rate that the gun is moved along the weld joint and is usually measured in mm per minute. Travel speeds can vary depending on conditions and the welders skill and is limited to the welders ability to control the weld pool. Push technique allows faster travel speeds than Drag technique. Gas flow must also correspond with the travel speed, increasing with faster travel speed and decreasing with slower speed. Travel speed needs to match the amperage and will decrease as the material thickness and amperage increase.

Too Fast Travel Speed- A too fast travel speed produces too little heat per mm of travel resulting in less penetration and reduced weld fusion, the weld bead solidifies very quickly trapping gases inside the weld metal causing porosity. Undercutting of the base metal can also occur and an unfilled groove in the base metal is created when the travel speed is too fast to allow molten metal to flow into the weld crater created by the arc heat.

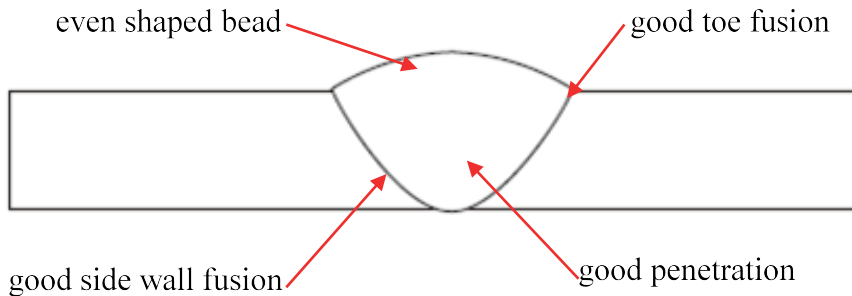


Too Slow Travel Speed- A too slow travel speed produces a large weld with lack of penetration and fusion. The energy from the arc dwells on top of the weld pool rather than penetrating the base metal. This produces a wider weld bead with more deposited weld metal per mm than is required resulting in a weld deposit of poor quality.



Correct Travel Speed - The correct travel speed keeps the arc at the leading edge of the weld pool allowing the base metal to melt sufficiently to create good penetration, fusion and wetting out of the weld pool producing a weld deposit of good quality.

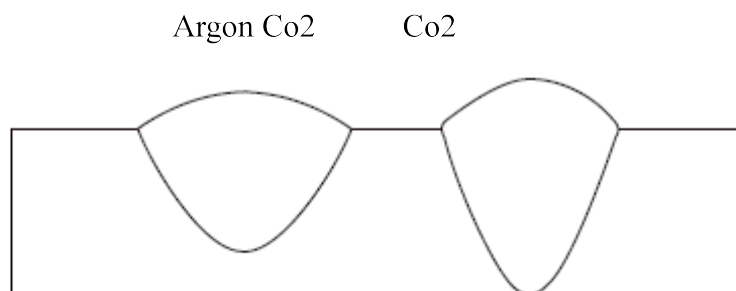
Correct Travel Speed



Gas selection - The purpose of the gas in the MIG process is to protect / shield the wire, the arc and the molten weld metal from the atmosphere. Most metals when heated to a molten state will react with the air in the atmosphere, without the protection of the shielding gas the weld produced would contain defects like porosity, lack of fusion and slag inclusions. Additionally some of the gas becomes ionised (electrically charged) and helps the current flow smoothly.

The correct gas flow is also very important in protecting the welding zone from the atmosphere. Too low flow will give inadequate coverage and result in weld defects and unstable arc conditions. Too high flow can cause air to be drawn into the gas column and contaminate the weld zone.

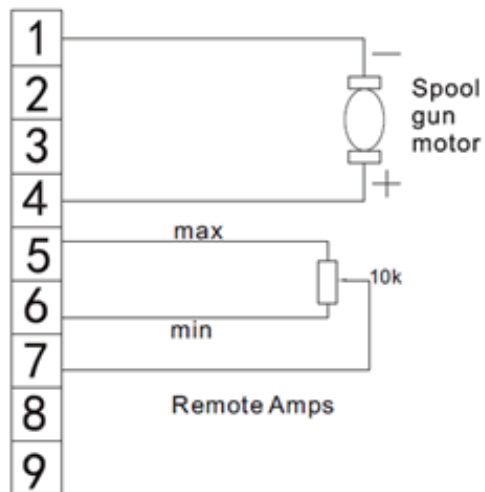
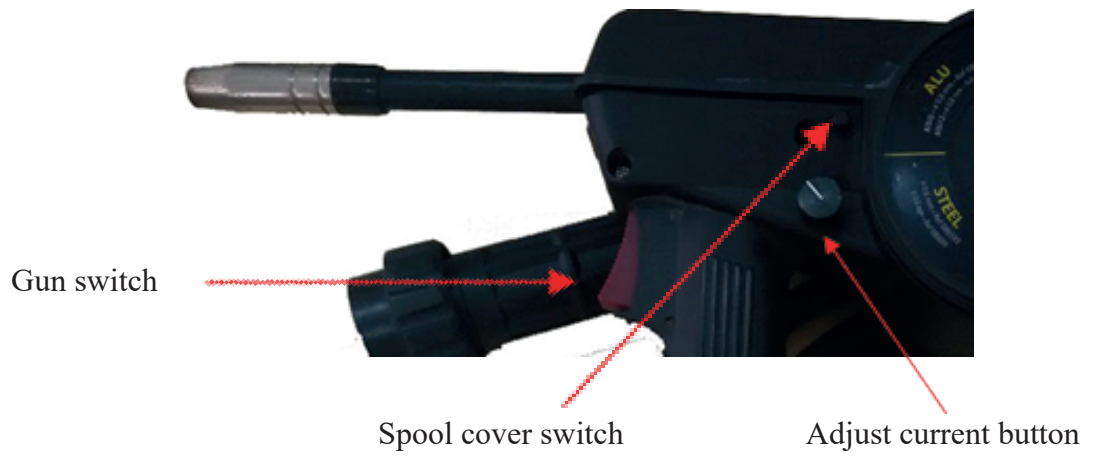
Use the correct shielding gas. Co₂ is good for steel and offers good penetration characteristics, the weld profile is narrower and slightly more raised than the weld profile obtained from Argon Co₂ mixed gas. Argon Co₂ mix gas offers better weld ability for thin metals and has a wider range of setting tolerance on the machine. Argon 80% Co₂ 20% is a good all round mix suitable for most applications.



Penetration Pattern for Steel

4.3.9 Spool Gun control

Spool Gun



Remote Control Socket

Socket Pin	Function
1	Spool gun motor
2	Not connected
3	Not connected
4	Spool gun motor
5	10k ohm (maximum) connection to 10k ohm remote control potentiometer.
6	Zero ohm (minimum) connection to 10k ohm remote control potentiometer.
7	Wiper arm connection to 10k ohm remote control potentiometer.
8	Not connected
9	Not connected

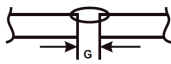
4.4 Standard welding programs

SYN Parameter			
PROGRAM NUMBER	MATERIAL	WIRE Φ (mm)	GAS
P1	Solid Fe	0.8	CO ₂
P2	Solid Fe	0.8	80%Ar+20%CO ₂
P3	Solid Fe	0.9	CO ₂
P4	Solid Fe	0.9	80%Ar+20%CO ₂
P5	Solid Fe	1.0	80%Ar+20%CO ₂
P6	Solid Fe	1.0	CO ₂
P7	Solid Fe	1.2	CO ₂
P8	Solid Fe	1.2	80%Ar+20%CO ₂
P9	Flux.c.w Fe	1.0	CO ₂
P10	Flux.c.w Fe	1.2	CO ₂
P11	SS ER316	1.0	98%Ar+2%CO ₂
P12	SS ER316	1.2	98%Ar+2%CO ₂
P13	Cu Si3	1.0	Ar100%
P14	Cu Si3	1.2	Ar100%
Dual Pulse Parameter			
PROGRAM NUMBER	MATERIAL	WIRE Φ (mm)	GAS
P1	AlMg5	0.9	Ar100%
P2	AlMg5	1.0	Ar100%
P3	AlMg5	1.2	Ar100%
P4	AlSi5	1.0	Ar100%
P5	AlSi5	1.2	Ar100%
P6	Al99.5	1.2	Ar100%
P7	Fe	0.8	80%Ar+20%CO ₂
P8	Fe	0.9	80%Ar+20%CO ₂
P9	Fe	1.0	80%Ar+20%CO ₂
P10	Fe	1.2	80%Ar+20%CO ₂
P11	SS ER316	1.0	98%Ar+2%CO ₂
P12	SS ER316	1.2	98%Ar+2%CO ₂
P13	Flux.c.w Fe	1.2	80%Ar+20%CO ₂
P14	Flux.c.w SS	1.2	80%Ar+20%CO ₂
P15	CuSi3	1.0	Ar100%
P16	CuSi3	1.2	Ar100%
P17	CuAl8	1.2	Ar100%

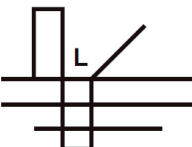
DISPLAY	FUNCTION
PrG	PRE GAS
PoG	POST GAS
SFt	SLOW FEED TIME
bub	BURN BACK
SPt	SPOT WELD TIME
dPC	DELTA PULSE CURRENT
FdP	DUAL PULSE FREQUENCY
dut	DUAL PULSE DUTY
bAL	DUAL PULSE BASE CURRENT ARC LENGTH
SCP	START CURRENT PERCENT
SAL	START CURRENT ARC LENGTH
ECP	END CURRENT PERCENT
EAL	END CURRENT ARC LENGTH
HdC	HYDROCOOLING
SPG	SPOOL GUN
HSt	HOT START
ACF	ARC FORCE
dSL	DOWN SLOPE

4.5 Welding parameters

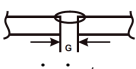
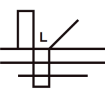
Process reference for CO₂ butt welding of low carbon steel solid welding wire

	Material thickness (MM)	Root gap G (MM)	Wire diameter (MM)	Welding current (A)	Welding voltage (V)	Welding speed (CM/MIN)	Gas-flow rate (L/MIN)
Butt-joint 	0.8	0	0.8	60-70	16-16.5	50-60	10
	1.0	0	0.8	75-85	17-17.5	50-60	10-15
	1.2	0	0.8	80-90	17-18	50-60	10-15
	2.0	0-0.5	1.0/1.2	110-120	19-19.5	45-50	10-15
	3.2	0-1.5	1.2	130-150	20-23	30-40	10-20
	4.5	0-1.5	1.2	150-180	21-23	30-35	10-20
	6	0	1.2	270-300	27-30	60-70	10-20
	6	1.2-1.5	1.2	230-260	24-26	40-50	15-20
	8	0-1.2	1.2	300-350	30-35	30-40	15-20
	8	0-0.8	1.6	380-420	37-38	40-50	15-20
	12	0-1.2	1.6	420-480	38-41	50-60	15-20

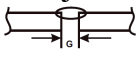
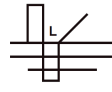
Process reference for CO2 corner welding of low carbon steel solid welding wire

Corner joint 	Material thickness (MM)	Wire diameter (MM)	Welding current (A)	Welding voltage (V)	Welding speed (CM/MIN)	Gas-flow rate (L/MIN)
	1.0	0.8	70-80	17-18	50-60	10-15
	1.2	1.0	85-90	18-19	50-60	10-15
	1.6	1.0/1.2	100-110	18-19.5	50-60	10-15
	1.6	1.2	120-130	19-20	40-50	10-20
	2.0	1.0/1.2	115-125	19.5-20	50-60	10-15
	3.2	1.0/1.2	150-170	21-22	45-50	15-20
	3.2	1.2	200-250	24-26	45-60	10-20
	4.5	1.0/1.2	180-200	23-24	40-45	15-20
	4.5	1.2	200-250	24-26	40-50	15-20
	6	1.2	220-250	25-27	35-45	15-20
	6	1.2	270-300	28-31	60-70	15-20
	8	1.2	270-300	28-31	60-70	15-20
	8	1.2	260-300	26-32	25-35	15-20
	8	1.6	300-330	25-26	30-35	15-20
	12	1.2	260-300	26-32	25-35	15-20
	12	1.6	300-330	25-26	30-35	15-20
16	1.6	340-350	27-28	35-40	15-20	
19	1.6	360-370	27-28	30-35	15-20	

Low carbon steel, stainless steel pulse MAG welding process reference

Welding position	Material thickness (MM)	Wire diameter (MM)	Welding current (A)	Welding voltage (V)	Welding speed (CM/MIN)	Nozzle and workpiece spacing (MM)	Gas-flow rate (L/MIN)
Butt-joint 	1.6	1.0	80-100	19-21	40-50	12-15	10-15
	2.0	1.0	90-100	19-21	40-50	13-16	13-15
	3.2	1.2	150-170	22-25	40-50	14-17	15-17
	4.5	1.2	150-180	24-26	30-40	14-17	15-17
	6.0	1.2	270-300	28-31	60-70	17-22	18-22
	8.0	1.6	300-350	39-34	35-45	20-24	18-22
	10.0	1.6	330-380	30-36	35-45	20-24	18-22
Corner joint 	1.6	1.0	90-130	21-25	40-50	13-16	10-15
	2.0	1.0	100-150	22-26	35-45	13-16	13-15
	3.2	1.2	160-200	23-26	40-50	13-17	13-15
	4.5	1.2	200-240	24-28	45-55	15-20	15-17
	6.0	1.2	270-300	28-31	60-70	18-22	18-22
	8.0	1.6	280-320	27-31	45-60	18-22	18-22
	10.0	1.6	330-380	30-36	40-55	20-24	18-22

Welding process of aluminum alloy pulse MIG

Welding position	Material thickness (MM)	Wire diameter (MM)	Welding current (A)	Welding voltage (V)	Welding speed (CM/MIN)	Nozzle and workpiece spacing(MM)	Gas-flow rate (L/MIN)
Butt-joint 	1.5	1.0	60-80	16-18	60-80	12-15	15-20
	2.0	1.0	70-80	17-18	40-50	15	15-20
	3.0	1.2	80-100	17-20	40-50	14-17	15-20
	4.0	1.2	90-120	18-21	40-50	14-17	15-20
	6.0	1.2	150-180	20-23	40-50	17-22	18-22
	4.0	1.2	160-210	22-25	60-90	15-20	19-20
	4.0	1.6	170-200	20-21	60-90	15-20	19-20
	6.0	1.2	200-230	24-27	40-50	17-22	20-24
	6.0	1.6	200-240	21-23	40-50	17-22	20-24
	8.0	1.6	240-270	24-27	45-55	17-22	20-24
	12.0	1.6	270-330	27-35	55-60	17-22	20-24
	16.0	1.6	330-400	27-35	55-60	17-22	20-24
Corner joint 	1.5	1.0	60-80	16-18	60-80	13-16	15-20
	2.0	1.0	100-150	22-26	35-45	13-16	15-20
	3.0	1.2	100-120	19-21	40-60	13-17	15-20
	4.0	1.2	120-150	20-22	50-70	15-20	15-20
	6.0	1.2	150-180	20-23	50-70	18-22	18-22
	4.0	1.2	180-210	21-24	35-50	18-22	16-18
	4.0	1.6	180-210	18-20	35-45	18-22	18-22
	6.0	1.2	220-250	24-25	50-60	18-22	16-24
	6.0	1.6	220-240	20-24	37-50	18-22	16-24
	8.0	1.6	250-300	25-26	60-65	18-22	16-24
	12.0	1.6	300-400	26-28	65-75	18-22	16-24

4.6 Operation environment

- ▲ Height above sea level ≤ 1000 M
- ▲ Operation temperature range $-10 \sim +40^{\circ}\text{C}$
- ▲ Air relative humidity is below 90 % (20°C)
- ▲ Preferable site the machine some angles above the floor level, the maximum angle does not exceed 15° .
- ▲ Protect the machine against heavy rain AND against direct sunshine.
- ▲ The content of dust, acid, corrosive gas in the surrounding air or substance cannot exceed normal standard.
- ▲ Take care that there is sufficient ventilation during welding. There must be at least 30cm free distance between the machine and wall.

4.7 Operation Notices

- ▲ Read Section §1 carefully before starting to use this equipment.
- ▲ Connect the ground wire with the machine directly
- ▲ Ensure that the input is single-phase: 50/60Hz, 110V/230V $\pm 10\%$.
- ▲ Before operation, none concerned people should not be around the working area and especially children. Do not watch the arc in unprotected eyes.
- ▲ Ensure good ventilation of the machine to improve Duty Cycle.
- ▲ Turn off the engine when the operation finished for energy consumption efficiency.
- ▲ When power switch shuts off protectively because of failure. Don't restart it until problem is resolved. Otherwise, the range of problem will be extended.
- ▲ In case of problems, contact your local dealer if no authorized maintenance staff is available!

6 Welding trouble shooting

6.1 MIG welding trouble shooting

The following chart addresses some of the common problems of MIG welding. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly adhered to and followed.

NO.	Trouble	Possible Reason	Suggested Remedy
1	Excessive Spatter	Wire feed speed set too high	Select lower wire feed speed
		Voltage too high	Select a lower voltage setting
		Wrong polarity set	select the correct polarity for the wire being used - see machine setup guide
		Stick out too long	Bring the torch closer to the work
		Contaminated base metal	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal
		Contaminated mig wire	Use clean dry rust free wire. Do not lubricate the wire with oil, grease etc
		Inadequate gas flow or too much gas flow	Check the gas is connected, check hoses, gas valve and torch are not restricted. Set the gas flow between 6-12 l/min flow rate. Check hoses and fittings for holes, leaks Protect the welding zone from wind and drafts

2	Porosity - small cavities or holes resulting from gas pockets in weld metal.	Wrong gas	Check that the correct gas is being used
		Inadequate gas flow or too much gas flow	Check the gas is connected, check hoses, gas valve and torch are not restricted. Set the gas flow between 10 - 15 l/min flow rate. Check hoses and fittings for holes, leaks etc .Protect the welding zone from wind and drafts
		Moisture on the base metal	Remove all moisture from base metal before welding
		Contaminated base metal	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal
		Contaminated mig wire	Use clean dry rust free wire. Do not lubricate the wire with oil, grease etc
		Gas nozzle clogged with spatter, worn or out of shape	Clean or replace the gas nozzle
		Missing or damaged gas diffuser	Replace the gas diffuser
		Mig torch euro connect o-ring missing or damaged	Check and replace the o-ring
3	Wire stubbing during welding	Holding the torch too far away	Bring the torch closer to the work and maintain stick out of 5-10mm
		Welding voltage set too low	Increase the voltage
		Wire Speed set too high	Decrease the wire feed speed
4	Lack of Fusion – failure of weld metal to fuse completely with base metal or a proceeding weld bead.	Contaminated base metal	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal
		Not enough heat input	Select a higher voltage range and /or adjust the wire speed to suit
		Improper welding technique	Keep the arc at the leading edge of the weld pool. Gun angle to work should be between 5 & 15° Direct the arc at the weld joint. Adjust work angle or widen groove to access bottom during welding. Momentarily hold arc on side walls if using weaving technique

5	Excessive Penetration – weld metal melting through base metal	Too much heat	Select a lower voltage range and /or adjust the wire speed to suit Increase travel speed
6	Lack of Penetration – shallow fusion between weld metal and base metal	Poor in incorrect joint preparation	Material too thick. Joint preparation and design needs to allow access to bottom of groove while maintaining proper welding wire extension and arc characteristics. Keep the arc at the leading edge of the weld pool and maintain the gun angle at 5 & 15° keeping the stick out between 5-10mm
		Not enough heat input	Select a higher voltage range and /or adjust the wire speed to suit Reduce travel speed
		Contaminated base metal	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal

6.2 MIG wire feed trouble shooting

The following chart addresses some of the common WIRE FEED problems during MIG welding. In all cases of equipment malfunction, the manufacturer’s recommendations should be strictly adhered to and followed.

NO.	Trouble	Possible Reason	Suggested Remedy
1	No wire feed	Wrong mode selected	Check that the TIG/MMA/MIG selector switch set to MIG position

		Wrong torch selector switch	Check that the Wire Feeder /Spool Gun selector switch is set to Wire Feeder position for MIG welding and Spool Gun when using the Spool gun
2	Inconsistent / interrupted wire feed	Adjusting wrong dial	Be sure to adjust the wire feed and voltage dials for MIG welding. The amperage dial is for MMA and TIG welding mode
		Wrong polarity selected	Select the correct polarity for the wire being used - see machine setup guide
		Incorrect wire speed setting	Adjust the wire feed speed
		Voltage setting incorrect	Adjust the voltage setting
		Mig torch lead too long	Small diameter wires and soft wires like aluminium don't feed well through long torch leads - replace the torch with a lesser length torch
		Mig torch lead kinked or too sharp angle being held	Remove the kink, reduce the angle or bend
		Contact tip worn, wrong size, wrong type	Replace the tip with correct size and type
		Liner worn or clogged (the most common causes of bad feeding)	Try to clear the liner by blowing out with compressed air as a temporary cure, it is recommended to replace the liner
		Wrong size liner	Install the correct size liner
		Blocked or worn inlet guide tube	Clear or replace the inlet guide tube
		Wire misaligned in drive roller groove	Locate the wire into the groove of the drive roller
		Incorrect drive roller size	Fit the correct size drive roller eg; 0.8mm wire requires 0.8mm drive roller
		Wrong type of drive roller selected	Fit the correct type roller (e.g. knurled rollers needed for flux cored wires)
		Worn drive rollers	Replace the drive rollers
		Drive roller pressure too high	Can flatten the wire electrode causing it to lodge in the contact tip - reduce the drive roller pressure
Too much tension on wire spool hub	Reduce the spool hub brake tension		
Wire crossed over on the spool or tangled	Remove the spool untangle the wire or replace the wire		

Wire crossed over on the spool or tangled	Remove the spool untangle the wire or replace the wire
Contaminated mig wire	Use clean dry rust free wire. Do not lubricate the wire with oil, grease etc

6.3 DC TIG welding trouble shooting

The following chart addresses some of the common problems of DC TIG welding. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly adhered to and followed.

NO.	Trouble	Possible Reason	Suggested Remedy
1	Tungsten burning away quickly	Incorrect Gas or No Gas	Use pure Argon. Check cylinder has gas, connected, turned on and torch valve is open
		Inadequate gas flow	Check the gas is connected, check hoses, gas valve and torch are not restricted.
		Back cap not fitted correctly	Make sure the torch back cap is fitted so that the o-ring is inside the torch body
		Torch connected to DC +	Connect the torch to the DC- output terminal
		Incorrect tungsten being used	Check and change the tungsten type if necessary
		Tungsten being oxidised after weld is finished	Keep shielding gas flowing 10-15 seconds after arc stoppage. 1 second for each 10amps of weld current.
2	Contaminated tungsten	Touching tungsten into the weld pool	Keep tungsten from contacting weld puddle. Raise the torch so that the tungsten is off of the work piece 2 - 5mm
		Touching the filler wire to the tungsten	Keep the filler wire from touching the tungsten during welding, feed the filler wire into the leading edge of the weld pool in front of the tungsten
3	Porosity - poor weld appearance and colour	Wrong gas / poor gas flow /gas leak	Use pure argon. Gas is connected, check hoses, gas valve and torch are not restricted. Set the gas flow between 6-12 l/min. Check hoses and fittings for holes, leaks et

		Contaminated base metal	Remove moisture and other materials
		Contaminated filler wire	Remove all grease, oil, or moisture from filler metal
		Incorrect filler wire	Check the filler wire and change if necessary
4	Yellowish residue / smoke on the alumina nozzle & discoloured tungsten	Incorrect Gas	Use pure Argon gas
		Inadequate gas flow	Set the gas flow between 10 - 15 l/min flow rate
		Alumina gas nozzle too small	Increase the size of the alumina gas nozzle
5	Unstable Arc during DC welding	Torch connected to DC +	Connect the torch to the DC- output terminal
		Contaminated base metal	Remove materials like paint, grease, oil, and dirt, including mill scale from base metal.
		Tungsten is contaminated	Remove 10mm of contaminated tungsten and re grind the tungsten
		Arc length too long	Lower torch so that the tungsten is off of the work piece 2 - 5mm
6	Arc wanders during DC welding	Poor gas flow	Check and set the gas flow between 10 - 15 l/min flow rate
		Incorrect arc length	Lower torch so that the tungsten is off of the work piece 2 - 5mm
		Tungsten incorrect or in poor condition	Check that correct type of tungsten is being used. Remove 10mm from the weld end of the tungsten and re sharpen the tungsten
		Poorly prepared tungsten	Grind marks should run lengthwise with tungsten, not circular. Use proper grinding method and wheel.
		Contaminated base metal or filler wire	Remove contaminating materials like paint, grease, oil, and dirt, including mill scale from base metal. Remove all grease, oil, or moisture from filler metal
7	Arc difficult to start or will not start DC welding	Incorrect machine set up	Check machine set up is correct
		No gas, incorrect gas flow	Check the gas is connected and cylinder valve open, check hoses, gas valve and torch are not restricted. Set the gas flow between 10 - 15 l/min flow rate

			10 - 15 l/min flow rate
		Loose connection	Check all connectors and tighten
		Incorrect tungsten size or type	Check and change the size and or the tungsten if required
		Earth clamp not connected to work	Connect the earth clamp directly to the work piece wherever possible

6.4 MMA welding trouble shooting

The following chart addresses some of the common problems of MMA welding. In all cases of equipment malfunction, the manufacturer's recommendations should be strictly adhered to and followed.

NO.	Trouble	Possible Reason	Suggested Remedy
1	No arc	Incomplete welding circuit	Check earth lead is connected. Check all cable connections.
		Wrong mode selected	Check the MMA selector switch is selected
		No power supply	Check that the machine is switched on and has a power supply
2	Porosity – small cavities or holes resulting from gas pockets in weld metal	Arc length too long	Shorten the arc length
		Work piece dirty, contaminated or moisture	Remove moisture and materials like paint, grease, oil, and dirt, including mill scale from base metal
		Damp electrodes	Use only dry electrodes
3	Excessive Spatter	Amperage too high	Decrease the amperage or choose a larger electrode
		Arc length too long	Shorten the arc length
4	Weld sits on top, lack of fusion	Insufficient heat input	Increase the amperage or choose a larger electrode
		Work piece dirty, contaminated or moisture	Remove moisture and materials like paint, grease, oil, and dirt, including mill scale from base metal
		Poor welding technique	Use the correct welding technique or seek assistance for the correct technique
5	Lack of penetration	Insufficient heat input	Increase the amperage or choose a larger electrode

		Poor welding technique	Use the correct welding technique
		Poor joint preparation	Check the joint design and fit up, make sure the material is not too thick Seek assistance for the correct joint design and fit up.
6	Excessive penetration - burn through	Excessive heat input	Reduce the amperage or use a smaller electrode
		Incorrect travel speed	Try increasing the weld travel speed
7	Uneven weld appearance	Unsteady hand, wavering hand	Use two hands where possible to steady up, practise your technique
8	Distortion – movement of base metal during welding	Excessive heat input	Reduce the amperage or use a smaller electrode
		Poor welding technique	Use the correct welding technique or seek assistance for the correct technique
		Poor joint preparation and or joint design	Check the joint design and fit up, make sure the material is not too thick. Seek assistance for the correct joint design and fit up
9	Electrode welds with different or unusual arc characteristic	Incorrect polarity	Change the polarity, check the electrode manufacturer for correct polarity

7 Maintenance & Troubleshooting

7.1 Maintenance

In order to guarantee safe and proper operation of welding machines, they must be maintained regularly. Let customers understand the maintenance procedure of welding machines. Enable customers to carry on simple examination and inspections. Do your best to reduce the fault rate and repair times of welding machines to lengthen service life of arc welding machine. Maintenance items in detail are in the following table.

- **Warning: for safety while maintaining the machine, please shut off the main input power and wait for 5 minutes, until capacitors voltage already drop to safe voltage 36V.**

Date	Maintenance items
Daily examination	<p>Observe that the knobs and switches in the front and at the back of arc welding machine are flexible and put correctly in place. If any knob has not been put correctly in place, please correct. If you can't correct or fix the knob, please replace immediately. If any switch is not flexible or it can't be put correctly in place, please replace immediately! Please get in touch with maintenance service department if there are no accessories.</p> <p>After turn-on power, watch/listen if the arc-welding machine has shaking, whistle calling or peculiar smell. If there is one of the above problems, find out the reason and clear it. If you can't find out the reason, please contact your local service repair station or distributor/Agent.</p> <p>Observe that the display value of LED is intact. If the display number is not intact, please replace the damaged LED. If it still doesn't work, please maintain or replace the display PCB.</p> <p>Observe that the min./max.Values on LED agree with the set value. If there is any difference and it has affected the normal welding results, please adjust it.</p> <p>Check whether the fan is damaged and whether it is normal to rotate or control. If the fan is damaged, please change immediately. If the fan does not rotate after the machine is overheated, observe if there is something blocking the blade. If it is blocked, please clear the problem. If the fan does not rotate after getting rid of the above problems, you can poke the blade by the rotation direction of fan. If the fan rotates normally, the start capacity should be replaced. If not, change the fan.</p> <p>Observe whether the fast connector is loose or overheated. If the arc-welding machine has the above problems, it should be fastened or changed.</p> <p>Observe whether the current output cable is damaged. If it is damaged, it should be insulated or changed.</p>

Monthly examination	Using the dry compressed air to clear the inside of arc welding machine. Especially for clearing up the dusts on radiator, main voltage transformer, inductors, IGBT modules, fast recover diodes, PCB's, etc. Check the screws and bolts in the machine. If any is loose, please screw it tight. If it is shaved, please replace. If it is rusty, please erase rust on all bolts to ensure it works well.
Quarter-yearly examination	Check whether the actual current accords with the displaying value. If they did not accord, they should be regulated. The actual welding current value can be measured by and adjusted by plier-type ampere meter.
Yearly examination	Measure the insulating impedance among the main circuit, PCB and case, if it below $1M\Omega$, insulation is thought to be damaged and need to change, and need to change or strengthen insulation.

7.2 Troubleshooting

- **Before the welding machines are dispatched from the factory, they have already been tested and calibrated accurately. It is forbidden for anyone who is not authorized by our company to do any change to the equipment!**
- Maintenance course must be operated carefully. If any wire becomes flexible or is misplaced, it may be potential danger to user!
- Only professional maintenance staff that is authorized by our company could overhaul the machine!
- **Be sure to shut off the Main Input Power before doing any repair work on the welding machine!**
- If there is any problem and there is no authorized professional maintenance personal on site, please contact local agent or the distributor!

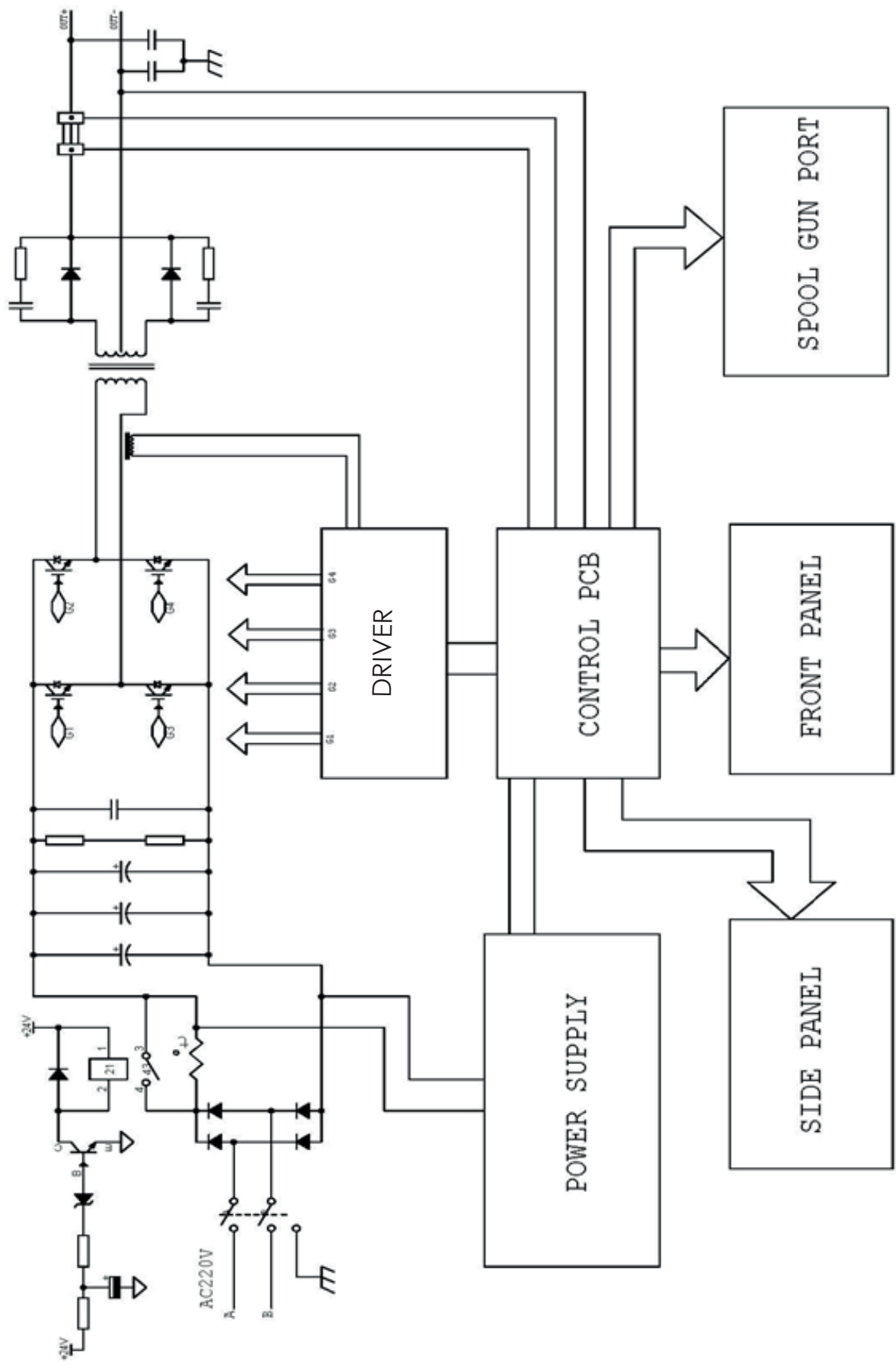
If there are some simple troubles with the welding machine, you can consult the following Chart:

NO.	Troubles		Reasons	Solution
1	Close the breaker, but the power light isn't on		Breaker damaged	Change it
			Fuse damaged	Change it
			Input power damaged	Change it
2	After welding machine is over-heat, the fan doesn't work		Fan damaged	Change it
			The cable is loose	Screw the cable tight
3	Press the gun switch, no output shielded gas	No output gas when test gas	No gas in the gas cylinder	Change it
			Gas hose leaks gas	Change it
			Electromagnetic valve damaged	Change it
		Output gas when test gas	Control switch damaged	Repair the switch
			Control circuit damaged	Check the PCB
4	Wire-feeder doesn't work	Wire reel doesn't work	Motor damaged	Check and change it
			Control circuit damaged	Check the PCB
		Wire reel works	The press wheel is loosen or weld wire skids	Press it tightly again
			The wheel doesn't fit with the diameter of weld wire	Change the wheel
			Wire reel damaged	Change it
			Wire feed pipe is jammed	Repair or change it
			Tip is jammed because of splash	Repair or change it
5	No striking arc and no output voltage		Output cable is connected incorrectly or loosen	Screw it down or change it
			Control circuit damaged	Check the circuit
6	Welding stops, and alarm light is on		Machine has self-protection	Check over-voltage, over-current, over-temperature, lower-voltage and over-temperature, and solve it
7	Welding current is run away and can be not controlled		The potentiometer damaged	Check or change it
			The control circuit damaged	Check the circuit
8	The crater current can be not adjusted		The PCB damaged	Check it
9	No post-gas		The PCB damaged	Check it

7.3 List of error code

Error Type	Error code	Description	Lamp status
Thermal relay	E01	Over-heating(1st thermal relay)	Yellow lamp(thermal protection) always on
	E02	Over-heating(2nd thermal relay)	Yellow lamp(thermal protection) always on
	E03	Over-heating(3rd thermal relay)	Yellow lamp(thermal protection) always on
	E04	Over-heating(4th thermal relay)	Yellow lamp(thermal protection) always on
	E09	Over-heating(Program in default)	Yellow lamp(thermal protection) always on
Welding machine	E10	Phase loss	Yellow lamp(thermal protection) always on
	E11	No water	Yellow lamp(lack water) always on
	E12	No gas	Red lamp always on
	E13	Under voltage	Yellow lamp(thermal protection) always on
	E14	Over voltage	Yellow lamp(thermal protection) always on
	E15	Over current	Yellow lamp(thermal protection) always on
	E16	Wire feeder over load	
Switch	E20	Button fault on operating panel when switch on the machine	Yellow lamp(thermal protection) always on
	E21	Other faults on operating panel when switch on the machine	Yellow lamp(thermal protection) always on
	E22	Torch fault when switch on the machine	Yellow lamp(thermal protection) always on
	E23	Torch fault during normal working process	Yellow lamp(thermal protection) always on
Communication	E40	Connection problem between wire feeder and power source	
	E41	Communication error	

7.4 Electrical schematic drawing





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