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# 1. Working principle and structure of inverter welder

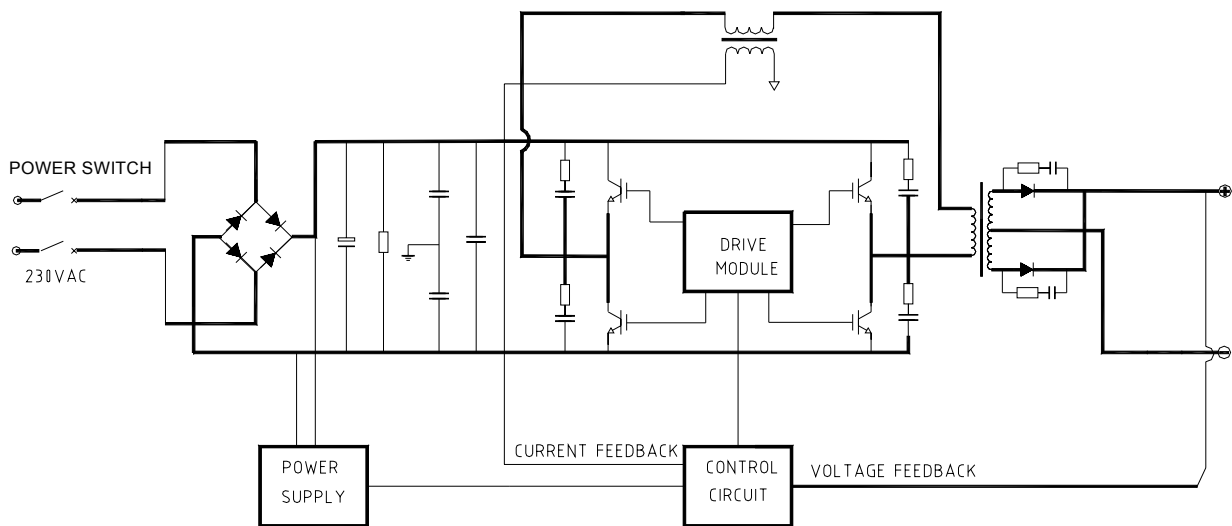
## 1.1 General description of MMA

Manual metal arc welding, MMA for short, melts the electrode and workpiece with the stably igniting arc established between them to get firm weld joints.

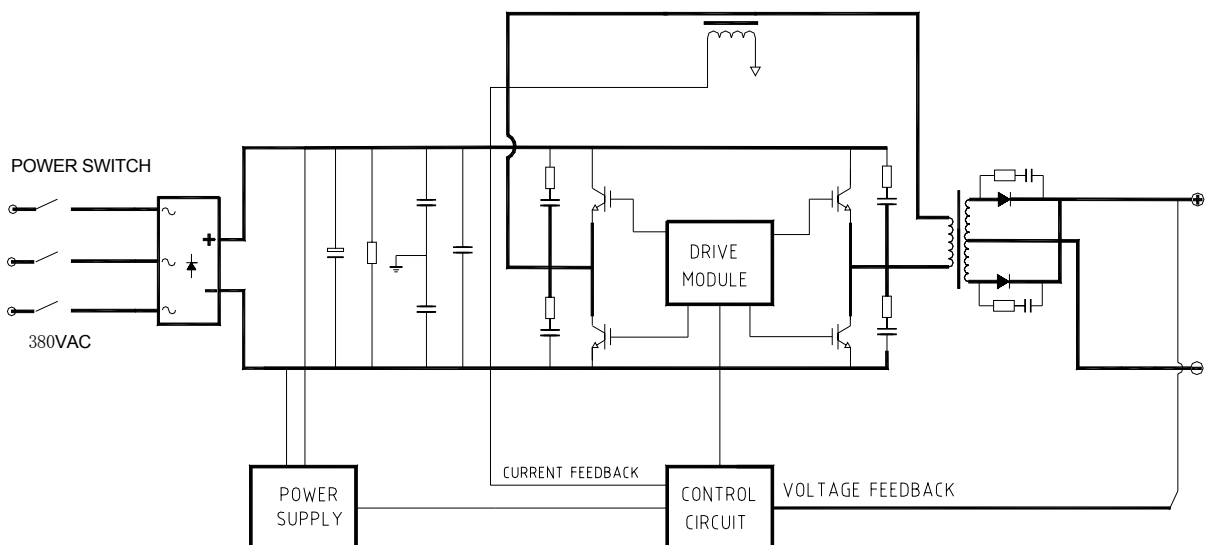
The electrode is composed of a core rod with an extruded chemical covering. The core rod melts in the arc and tiny droplets of molten metal shoot across into the molten pool. The electrode provides additional filler metal for the joint to fill the groove or gap between the two pieces of the base metal. The covering also melts or burns in the arc. It has several functions. It makes the arc steadier, provides a shield of smoke-like gas around the arc to keep oxygen and nitrogen in the air away from the molten metal, and provides a flux for the molten pool. The flux picks up impurities and forms the protective slag.

## 1.2 Working principle of inverter MMA machine

The inverter MMA machines made by our company can be divided into single-phase models and three-phase models according to their different input power supply, and the machine is composed of the power rectifier module, drive module, inverter components, auxiliary power module, HF transformer, secondary rectifier module and the control circuit. The schematic block diagrams are as below.



**Schematic block diagram of single-phase MMA machines**



**Schematic block diagram of three-phase MMA machines**

### 1.3 Main components of inverter welder

Inverter MMA machine of Jasic super welder series is composed of the below components:

- 1) Power cord
- 2) Fan
- 3) Inverter PCB (available in three-phase models)
- 4) HF transformer
- 5) Rectifier PCB
- 6) Secondary rectifier PCB (available in three-phase models)
- 7) Auxiliary power
- 8) Control PCB (Control circuit and inverter circuit are integrated in single-phase models.)
- 9) Meter (available in some of the models)
- 10) Bottom PCB or power PCB




The function and characteristics of each component are described as below.




Main components	Function	Characteristics
<b>Power cord</b>	It brings the external mains power into the inverter welder. Since the power consumption of the welder is large, the current-carrying capacity of the power cord should be high enough. If the diameter of the power cord is too small, the power cord will be heated, and the sheath of the power cord will be hardened or even burned if used for a long time.	--
<b>Fan</b>	It is a component inside the machine for cooling purpose. Currently, there are two kinds of fans for this series machines, namely AC fans and DC fans. AC fans are divided into two types; one type is with capacitor and the other without. DC fans are divided into two types; one type is with sleeve bearing, and the other is with oilless bearing.	AC fan is more durable and with less noise, but the air flow of it is not as strong as that of DC fan. DC fan may generate more noise because of its stronger air flow.
<b>Inverter PCB</b>	It is one of the important components to complete the inversion of power supply in the inverter welder. It converts the DC rectified from the mains power into HF AC, and then transfers it to the HF transformer. The PWM control signal is electrically isolated by the drive board. Thus, the critical component IGBT is controlled, and the DC is converted into AC. Generally, the maximum allowable voltage for IGBT in single-phase inverter machine is 600V, and the maximum allowable voltage for IGBT in three-phase inverter machine is 1000V or 1200V.	Combining current type PWM control with full-bridge inverter circuit, it can control the instantaneous current of IGBT more effectively. Thus, IGBT overcurrent caused by frequent short circuit during welding can be avoided, and the reliability of the machine is greatly improved.
<b>HF transformer</b>	It is one of the important components to complete the inversion of power supply in the inverter welder. HF transformer used in Jasic super welder series machines can be divided into ferrite type and amorphous nanometer type according to different magnetic core materials, and it is the critical component for the conversion between electric filed energy and magnetic field energy. Transformer of different specifications may be used in different models.	Light weight, small size and high efficiency.
<b>Secondary rectifier PCB</b>	It converts the LV AC high current output from the HF transformer into DC for welding.	It adopts several parallel fast recovery diodes. Beside, its cost is low and the solution is mature and reliable.

<p><b>Auxiliary power</b></p>	<p>It provides power supply for the control circuit and drive circuit. There are two kinds of auxiliary power for Jasic super welder series machines, namely industrial frequency transformer and flyback switching power supply.</p>	<p>Industrial frequency transformer brings little interference to the machine, and flyback switching power supply is small in size.</p>
<p><b>Control PCB</b></p>	<p>Control circuit and inverter circuit are integrated in single-phase models of Jasic super welder series. Control PCB is the critical component in the inverter welder, and it is composed of auxiliary power module, IGBT control module, voltage detection module, current detection module, temperature detection module, VRD/anti-sticking/lift arc ignition function module and meter display module (not available in some of the models).</p>	<ol style="list-style-type: none"> <li>1. IGBT: &lt;85°C, Fairchild</li> <li>2. PWM chip: KA3846 produced by Fairchild</li> <li>3. Capacitor: Polyester film capacitor and electrolytic capacitor are mostly used, and tantalum capacitor, monolithic ceramic capacitor and ceramic capacitor are used partially in some critical position. All capacitors are made in China.</li> <li>4. Rectifier bridge: It converts the AC power into DC power, in order to generate DC voltage, and it is made in China.</li> <li>5. Integrated operational amplifier: LM324 and TL084 produced by ST.</li> <li>6. MOSFET for IGBT drive: Manostat IRFZ24 and IRF9Z24 produced by IR.</li> <li>7. Manostat: 7805, 7815 and 7915 produced by Fairchild.</li> <li>8. Optical coupler: P521 produced by TOSHIBA or PC817 made in China.</li> </ol>

## 1.4 Preparation before the repair of inverter welder

### 1) Repair tools

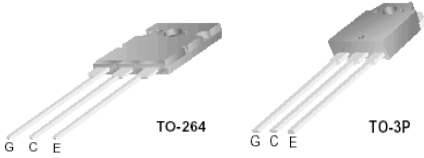
Tool	Requirements	Photo
<p><b>Digital multimeter</b></p>	<p>It can test diode, resistance, voltage, current, capacitance and inductance.</p>	
<p><b>Screwdriver and tweezers</b></p>	<p>Phillips screwdriver: 6mm (metric) Slotted screwdriver: 3mm (metric)</p>	
<p><b>Iron</b></p>	<p>Antistatic, long lifespan, temperature adjustable</p>	

<b>Pliers</b>	Snipe nose pliers and wire cutters	
<b>Double open-end spanner and inner hexagon spanner</b>	Specification (metric): M8~M10, M12~M14 and M17~M19	
<b>Heat conductive silicon grease</b>	--	

## 2) Preparation before repair



- Lay the machine on a flat and clear ground, clear the dust on the machine, and remove the screws on the machine cover with a screwdriver or spanner. (For models with plastic panels, since the machine cover is fixed by the front panel and back panel pressing from both sides, users should loosen the screws on the back panel when removing the screws on the machine cover, and put the machine upside down to remove the screws.)
- Put the machine right side up on a flat and clear ground after removing the screws, uncover the machine and clear the dust inside it. (For models with plastic panels, the machine cover can be taken out only by pulling the back panel back.) Observe the machine to see whether there is any obvious failure, and find out the fault location.

## 3) Critical components testing

Component	Testing item	Testing method
<b>IGBT</b>	Check if it is broken down.	<p>With the multimeter in diode check mode, check if there is any breakdown among the emitter, connector and gate. If the emitter to gate and the connector to gate are tested as open in both positive and negative directions, the IGBT is not damaged. See the below photos for the pin assignment of IGBT.</p> 
<b>Electrolytic capacitor</b>	Check if phenomenon such as vent operation or leakage of electrolyte exists.	Eyeballing
<b>Cement resistor (150Ω/10W)</b>	Check if it is blown out or check if it is burned with an instrument.	Eyeballing
<b>Main transformer</b>	Check if it is damaged.	Eyeballing
<b>Fan</b>	Check the fan for clogging.	Eyeballing

#### 4) Safety guidelines for repair

Take good protection when repairing the machine, for it may cause damage to you and others, so. For details, please refer to the operator safety guidelines in conformity with the accident prevention requirements of the manufacturer.

	<p><b>Service and repair should only be performed by trained and qualified individuals.</b></p>
	<p><b>Electric shock can cause personal injury or even can kill.</b></p> <ul style="list-style-type: none"><li>● Disconnect input power before maintenance or repair.</li><li>● Install earth device in accordance with the application criteria.</li><li>● Make sure that you are insulated from the ground and workpiece.</li></ul>

#### 5) Notes after repair

Pay attention to the below points after the repair work is done.

- Make sure that all screws inside the machine are of the proper specification and are tightened before covering the machine.
- Make sure that IGBT is coated with heat conductive silicon grease.
- Make sure that all components are correctly and well connected before connecting the machine to the input power.
- Make sure that there are no foreign matters inside the machine.

After the above items are confirmed no problem, connect the machine to the input power. If everything goes well, disconnect the input power, and cover the machine. After tightening the screws on the machine cover, connect the input power and test the machine again.

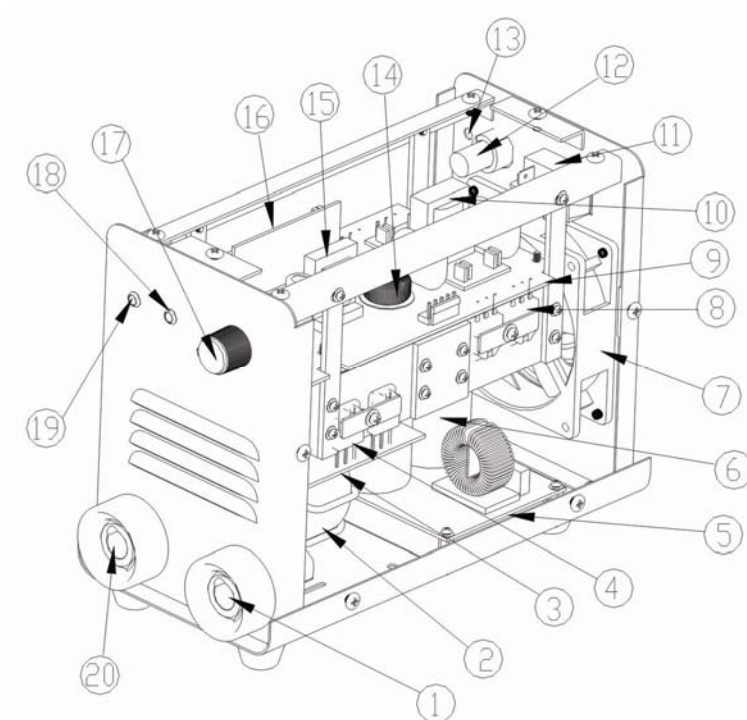
## 2. Single-phase inverter welder ARC100



## 2.1 Main technical parameters

Model	ARC100	ARC100
Rated input voltage (V)	AC115V±15%, 50/60Hz	AC230V±15%, 50/60Hz
Rated input power (KVA)	3.8	3.8
Rated output	100A/24V	100A/24V
Welding current range (A)	10~100A	10~100A
No-load voltage (V)	67	67
Rated duty cycle	25%@40℃	25%@40℃
Efficiency (%)	85	85
Power factor	0.75	0.75
Protection class	IP21	IP21
Insulation class	F	F
Overall size (mm)	245×123×177	245×123×177
Weight (Kg)	3	3

## 2.2 Machine structure



No.	Part name	No.	Part name	No.	Part name
1	"-" output terminal	8	IGBT	15	Auxiliary power transformer
2	Main transformer	9	Top PCB	16	PWM control board
3	Center PCB	10	Drive transformer	17	Current potentiometer
4	Fast recovery diode	11	Power switch	18	Overheating LED
5	Bottom PCB	12	Power cord	19	Power LED
6	Electrolytic capacitor	13	Screw hole for earth wire	20	"+" output terminal
7	DC fan	14	Current sensor		

## 2.3 Troubleshooting



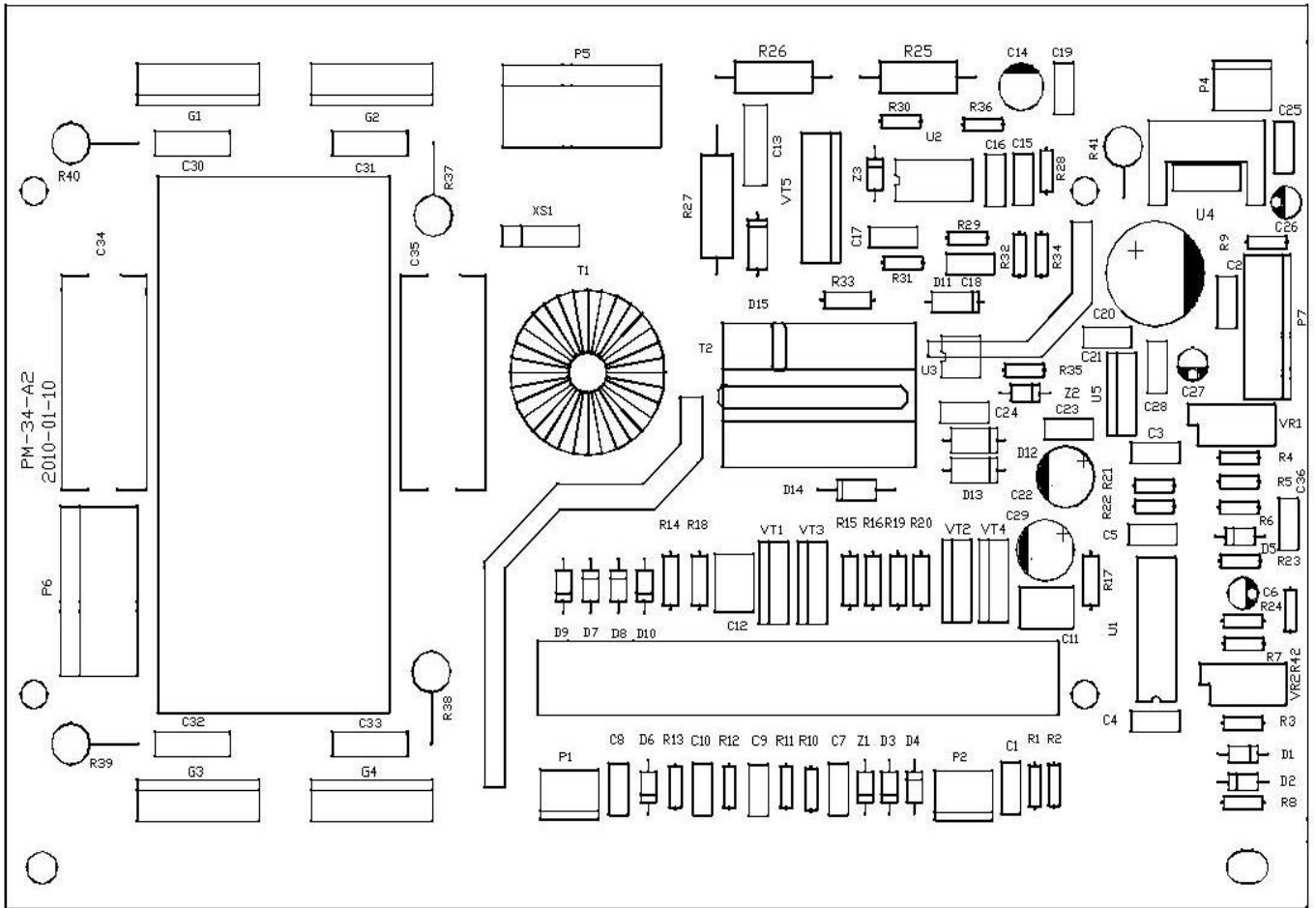
**WARNING:** The following operation requires sufficient professional knowledge on electric aspect and comprehensive safety knowledge. Operators should be holders of valid qualification certificates which can prove their skills and knowledge. Make sure the input cable of the machine is disconnected from the electricity utility before uncovering the welding machine.

Malfunction phenomena	Cause and solution
The power LED is off, the fan does not work, and there is no welding output.	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal.</li> <li>2. Check if the input cable is well connected to the power switch, and if the power switch can work normally.</li> <li>3. Check if the silicon bridge, IGBT or rectifier diode is damaged, and if the gate resistor is burned. Replace them if necessary.</li> <li>4. Connect the input power to the machine, and check if there is DC 310V at both ends of P4 on the power PCB PZ-71-A0 with the digital multimeter in DC voltage check mode. If there is, replace the control PCB (the top PCB PM-34-A0). Otherwise, replace the rectifier filter PCB (PZ-71-A0).</li> </ol>
The fan works, but the output current during welding is unstable and can not be controlled by the potentiometer.	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal.</li> <li>2. Check if the connecting wires on the control PCB are well connected.</li> <li>3. Check if the current potentiometer is damaged, and replace it if necessary.</li> <li>4. Replace the control PCB. If the problem remains, replace the rectifier PCB.</li> </ol>
The power LED is on, the fan works, but there is no welding output.	<ol style="list-style-type: none"> <li>1. Check if the connecting wires on all PCBs are well connected.</li> <li>2. The output terminal is not well connected.</li> <li>3. The protection LED is on: Pull the thermal switch out, and check if the protection LED is still on. If it is off, it indicates that overheating protection occurs. Otherwise, replace the control PCB. If the machine is under overheating protection status, it can recover automatically after the welding machine is cooled.</li> <li>4. The protection LED is off: Check if there is no-load voltage (about 76V). If no no-load voltage, pull the thermal switch out, and check again. If there is, replace the thermal switch because it is damaged. Otherwise, check if there is about 8.4V with the black probe connected to the metal part of 7815 and the red probe connected to the metal part of IRF9Z24 or IRFZ24. If there is, replace the center PCB (PD-45-A0). Otherwise, replace the control PCB (the top PCB PM-34-A0).</li> </ol>
The electrode holder becomes very hot.	The rated current of the electrode holder is lower than its actual working current. Replace it with a higher rated current.
Excessive spatter in MMA welding.	The output polarity connection is incorrect. Exchange the polarity.

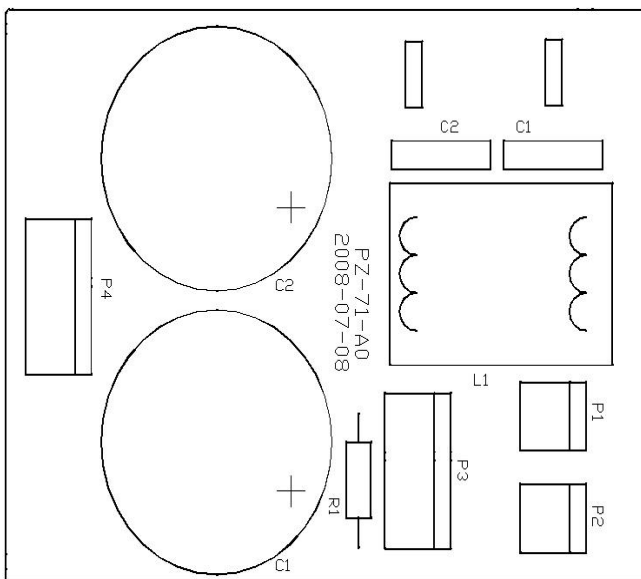


## 2.4 Appendix

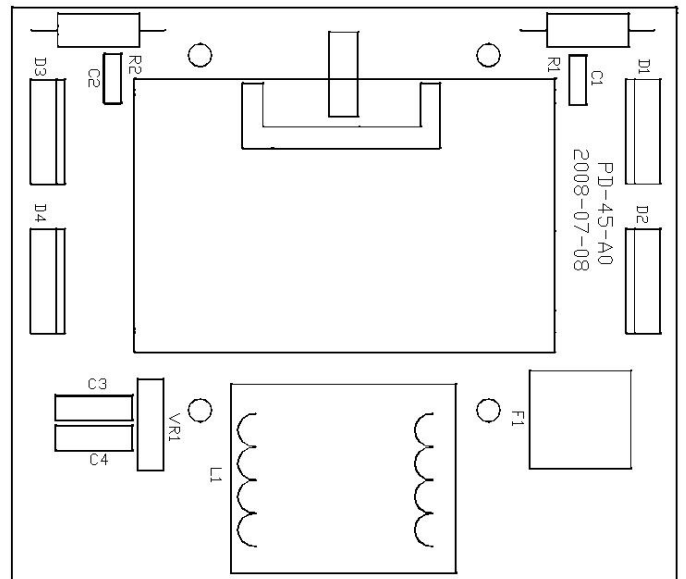
### 1) Bare PCB diagrams



**PM-34-A2**



**PZ-71-A0**



**PD-45-A0**

## 2) Test data for chip pins

Tested machine: ARC100							
Tested chip (U1 on PWM control module): KA3846							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	6.0K	6.0K	2.5V	9	3.91K	3.91K	
2	4.2K	4.2K	5V	10	12.56K	12.56K	
3	Grounded	Grounded	0V	11	1.99M	18.54M	
4	116.5Ω	116.5Ω		12	0.0Ω	0.0Ω	
5	15.16M	∞		13	900Ω	900Ω	
6	12.85M	∞		14	13.13M	18.58M	
7	12.85M	∞		15	900Ω	900Ω	15V
8	13.20M	∞		16	75Ω	75Ω	

**Note: Do not test pin-4 and pin-5 of KA3846 with the multimeter when it is electrified.**

Tested machine: ARC100							
Tested chip (U2 on PWM control module): TL084							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	22.9K	22.9K	12.31V	8	1.11K	1.11K	
2	59.2K	59.2K		9	1.11K	1.11K	
3	0.0Ω	0.0Ω		10	13.15M	∞	
4	900Ω	900Ω	15V	11	6.51K	6.51K	-15V
5	4.1K	4.1K		12	9.85K	10K	
6	2.6K	2.6K	5.4V	13	15.13M	∞	
7	∞	3.04M		14	15M	∞	

Tested machine: ARC100							
Tested chip (U1 on the top PCB): LM324							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	∞	∞		8	466K	466K	
2	33.6K	33.6K		9	466K	466K	
3	98K	83.6K		10	3.37K	3.37K	
4	1K	1K	15V	11	8.11K	8.03K	-15V
5	Grounded	Grounded		12	9.98K	9.98K	
6	Grounded	Grounded		13	1K	1K	
7	∞	∞		14	30.5K	30.5K	

### 3) Spare parts list

No.	Part number	Part name
1	D24048	IGBT-SKW20N60
2	RSD04025	Rectifier diode D92-02
3	D02387	Electrolytic capacitor CD-470uF-400V
4	D01252	Cement resistor SQM-10W-150Ω
5	D19049	IC KA3846
6	D19003	IC UC3843BN(ON)
7	D19026	IC TL084
8	D05109	NMOS transistor IRFZ24N
9	D05112	PMOS transistor IRF9Z24N
10	RSD05113	High-power MOS transistor 2SK2611
11	D03597	Auxiliary power transformer HS21318/01(200:16:33:33)
12	D04029	Rectifier diode UF4004
13	D18018	Silicon bridge S25VB100
14	D19011	Zener diode KA7815
15	D15101	Carbon film potentiometer WH30P-B1K-20/3

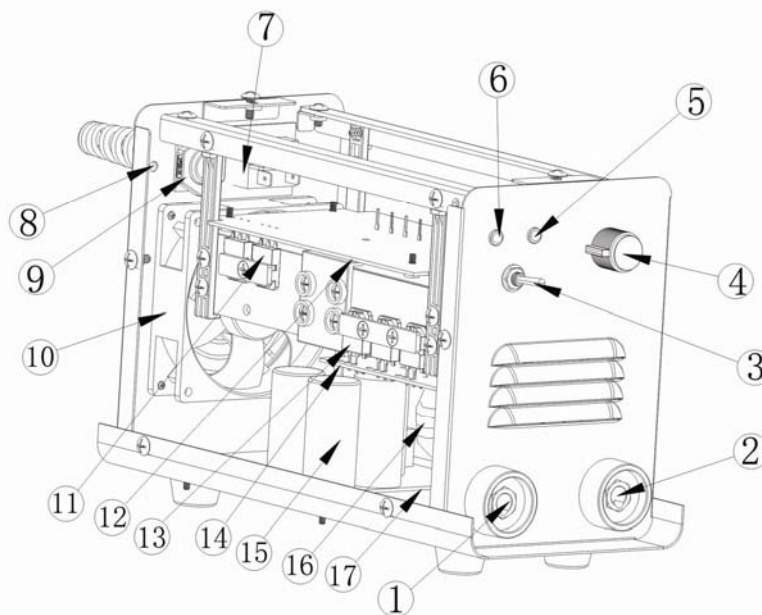
### 3. Single-phase inverter welder ARC120/ARC130



### 3.1 Main technical parameters

Model	ARC120	ARC130
Rated input voltage (V)	AC230V±15%, 50/60Hz	
Rated input power (KVA)	4.7	5.1
Rated output	120A/24.8V	130A/25.2V
Welding current range (A)	10~120A	10~130A
No-load voltage (V)	67	67
Rated duty cycle	25%@40°C	25%@40°C
Efficiency (%)	85	85
Power factor	0.75	0.75
Protection class	IP21S	IP21S
Insulation class	F	F
Overall size (mm)	245×123×177	245×123×177
Weight (Kg)	3	3

### 3.2 Machine structure



No.	Part name	No.	Part name
1	“+” output terminal	10	DC fan
2	“-” output terminal	11	IGBT
3	MMA/TIG switch	12	Top PCB
4	Current potentiometer	13	Fast recovery diode
5	Overcurrent LED	14	Center PCB
6	Power LED	15	Electrolytic capacitor
7	Power switch	16	Main transformer
8	Screw hole for earth wire	17	Bottom PCB
9	Buckle for power cord		

### 3.3 Troubleshooting

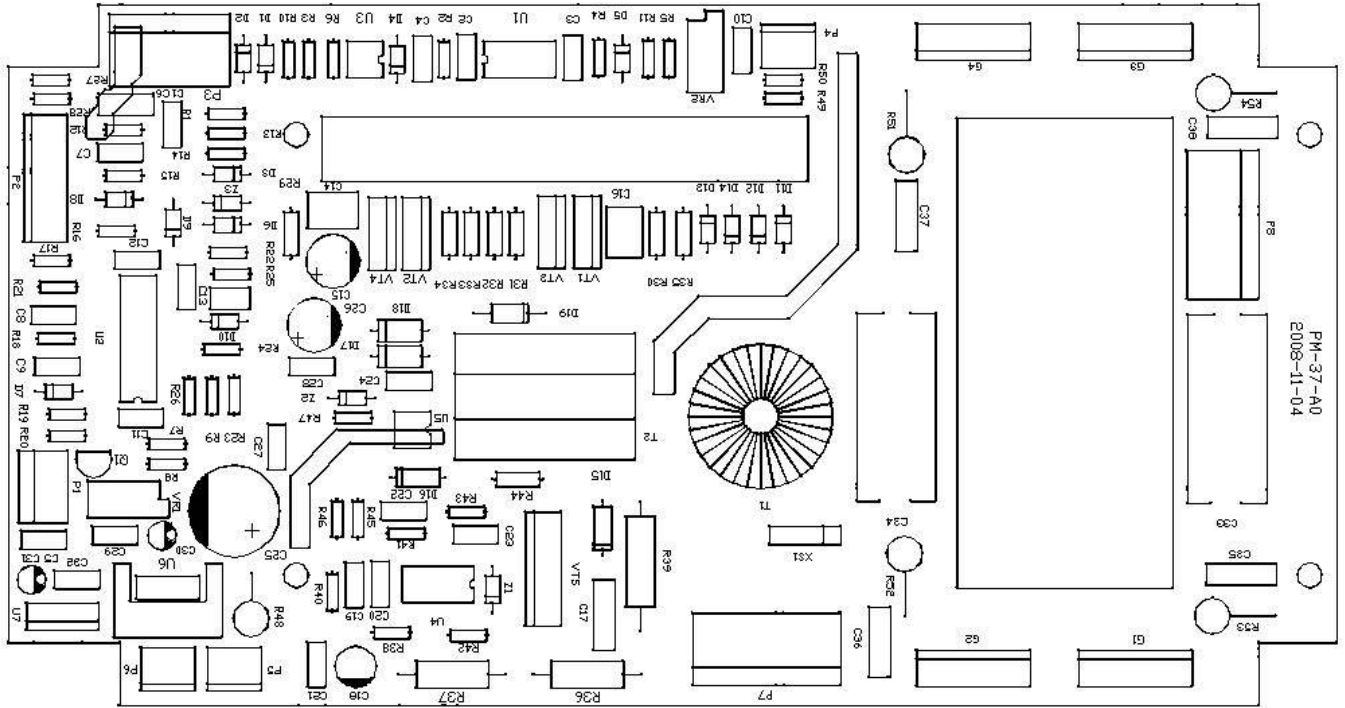


**WARNING:** The following operation requires sufficient professional knowledge on electric aspect and comprehensive safety knowledge. Operators should be holders of valid qualification certificates which can prove their skills and knowledge. Make sure the input cable of the machine is disconnected from the electricity utility before uncovering the welding machine.

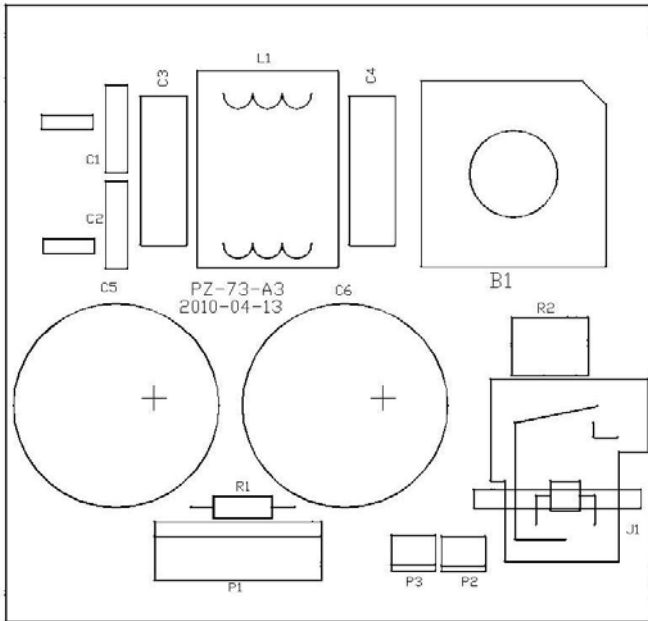
Malfunction phenomena	Cause and solution
The power LED is off, the fan does not work, and there is no welding output.	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal.</li> <li>2. Check if the input cable is well connected to the power switch, and if the power switch can work normally.</li> <li>3. Check if the silicon bridge, IGBT or rectifier diode is damaged, and if the gate resistor of IGBT is burned. Replace them if necessary.</li> <li>4. Connect the input power to the machine, and check if there is DC 310V at both ends of P4 on the power PCB PZ-71-A0 with the digital multimeter in DC voltage check mode. If there is, replace the control PCB (the top PCB PM-34-A0). Otherwise, replace the rectifier filter PCB (PZ-71-A0).</li> </ol>
The fan works, but the output current during welding is unstable and can not be controlled by the potentiometer.	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal.</li> <li>2. Check if the connecting wires on the control PCB PM-37-A0 are well connected.</li> <li>3. Check if the current potentiometer is damaged, and replace it if necessary.</li> <li>4. Replace the control PCB PM-37-A0. If the problem remains, replace the rectifier PCB PZ-73-A3.</li> </ol>
The power LED is on, the fan works, but there is no welding output.	<ol style="list-style-type: none"> <li>1. Check if the connecting wires on all PCBs are well connected.</li> <li>2. The output terminal is not well connected.</li> <li>3. The protection LED is on: Pull the thermal switch out, and check if the protection LED is still on. If it is off, it indicates that overheating protection occurs. Otherwise, replace the control PCB. If the machine is under overheating protection status, it can recover automatically after the welding machine is cooled.</li> <li>4. The protection LED is off: Check if there is no-load voltage (about 76V). If no no-load voltage, pull the thermal switch out, and check again. If there is, replace the thermal switch because it is damaged. Otherwise, check if there is about 8.4V with the black probe connected to the metal part of 7815 and the red probe connected to the metal part of IRF9Z24 or IRFZ24. If there is, replace the center PCB (PD-47-A2). Otherwise, replace the control PCB (the top PCB PM-37-A0).</li> </ol>
The electrode holder becomes very hot.	The rated current of the electrode holder is lower than its actual working current. Replace it with a higher rated current.
Excessive spatter in MMA welding.	The output polarity connection is incorrect. Exchange the polarity.

### 3.4 Appendix

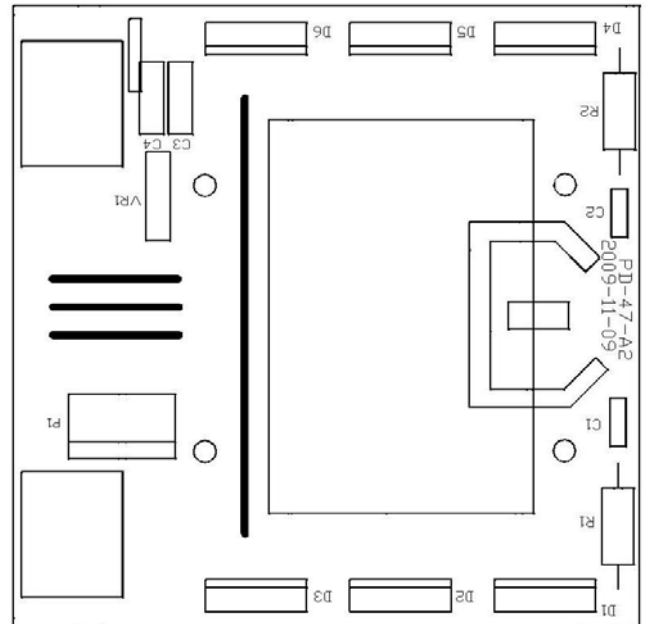
#### 1) Bare PCB diagrams



**PM-37-A0**



**PZ-73-A3**



**PD-47-A2**

## 2) Test data for chip pins

Tested machine: ARC120/ARC130							
Tested chip (U1 on PWM control module): KA3846							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	6.0K	6.0K	2.5V	9	3.91K	3.91K	
2	4.2K	4.2K	5V	10	12.56K	12.56K	
3	0.0Ω	0.0Ω	0V	11	1.99M	18.54M	
4	116.5Ω	116.5Ω		12	0.0Ω	0.0Ω	
5	15.16M	∞		13	900Ω	900Ω	
6	12.85M	∞		14	13.13M	18.58M	
7	12.85M	∞		15	900Ω	900Ω	15V
8	13.20M	∞		16	75Ω	75Ω	

**Note: Do not test pin-4 and pin-5 of KA3846 with the multimeter when it is electrified.**

Tested machine: ARC120/ARC130							
Tested chip (U2 on PWM control module): TL084							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	22.9K	22.9K	12.31V	8	1.11K	1.11K	
2	59.2K	59.2K		9	1.11K	1.11K	
3	0.0Ω	0.0Ω		10	13.15M	∞	
4	900Ω	900Ω	15V	11	6.51K	6.51K	-15V
5	4.1K	4.1K		12	9.85K	10K	
6	2.6K	2.6K	5.4V	13	15.13M	∞	
7	∞	3.04M		14	15M	∞	

Tested machine: ARC120/ARC130							
Tested chip (U1 on the top PCB): TL084							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	∞	∞		8	466K	466K	
2	33.6K	33.6K	0.77V	9	466K	466K	
3	98K	83.6K		10	3.37K	3.37K	
4	1K	1K	15V	11	8.11K	8.03K	-15V
5	Grounded	Grounded		12	9.98K	9.98K	
6	Grounded	Grounded		13	1K	1K	
7	∞	∞		14	30.5K	30.5K	

Tested machine: ARC120/ARC130							
Tested chip (U2 on the top PCB): LM324							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	14.95K	∞		8	17.87M	∞	
2	14.95K	33.6K	0.88V	9	∞	∞	
3	18.68K	83.6K		10	27.4K	27.4K	0.68V
4	857 Ω	857 Ω	15V	11	5.7K	5.7K	-15V
5	3.26K	3.26K		12	∞	∞	7.4V
6	14.95M	18.7M		13	∞	∞	
7	14.95M	18.7M		14	17.78M	∞	

### 3) Spare parts list

No.	Part number	Part name
1	D24050	IGBT-FGH40N60
2	RSD04025	Rectifier diode D92-02
3	D02387	Electrolytic capacitor CD-470uF-400V
4	D01252	Cement resistor SQM-10W-150 Ω
5	D19049	IC KA3846
6	D19003	IC UC3843BN(ON)
7	D19026	IC TL084
8	D05109	NMOS transistor IRFZ24N
9	D05112	PMOS transistor IRF9Z24N
10	RSD05113	High-power MOS transistor 2SK2611
11	D03597	Auxiliary power transformer HS21318/01(200:16:33:33)
12	D04029	Rectifier diode UF4004
13	D18001	Silicon bridge S35VB100
14	D19011	Zener diode KA7815
15	D15101	Carbon film potentiometer WH30P-B1K-20/3

### 4. Single-phase inverter welder ARC140/ARC160/ARC170/ARC180

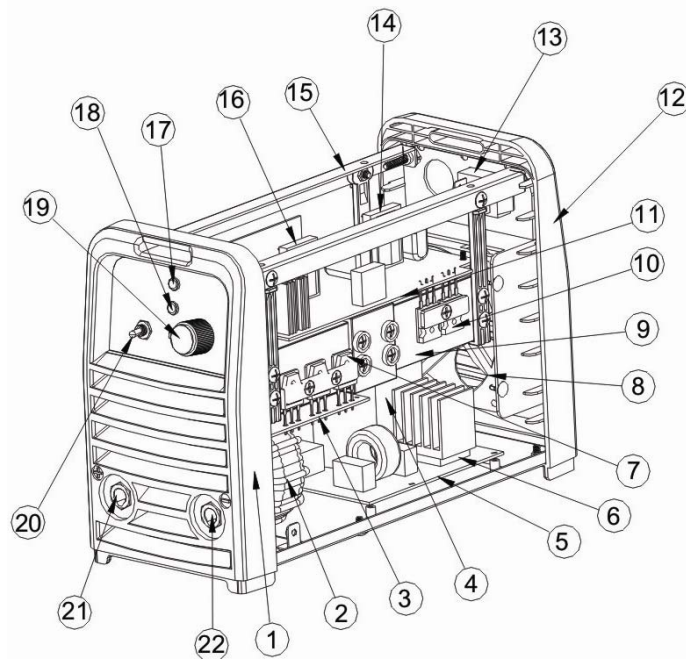




## 4.1 Main technical parameters

Model	ARC140	ARC160	ARC170	ARC180
Rated input voltage (V)	AC230V $\pm$ 15%, 50/60Hz			
Rated input power (KVA)	4.7	5.1	6	8
Rated output	140A/25.4V	160A/26.4V	170A/26.8V	180A/27.2V
Welding current range (A)	10~140A	10~160A	10~170A	10~180A
No-load voltage (V)	67	67	76	76
Rated duty cycle	30%@40 $^{\circ}$ C	30%@40 $^{\circ}$ C	30%@40 $^{\circ}$ C	30%@40 $^{\circ}$ C
Efficiency (%)	85	85	85	85
Power factor	0.70	0.70	0.70	0.72
Protection class	IP21	IP21	IP21	IP21
Insulation class	F	F	F	F
Overall size (mm)	290 $\times$ 120 $\times$ 198	313 $\times$ 120 $\times$ 198	313 $\times$ 120 $\times$ 198	336 $\times$ 120 $\times$ 198
Weight (Kg)	4.7	5.2	5.2	5.8

## 4.2 Machine structure



No.	Part name	No.	Part name	No.	Part name
1	Front panel	9	Heat sink for IGBT	17	Power LED
2	Main transformer	10	IGBT	18	Overheating LED
3	Center PCB	11	Top PCB	19	Current potentiometer
4	Electrolytic capacitor	12	Back panel	20	MMA/TIG switch
5	Bottom PCB	13	Power switch	21	"+" output terminal
6	Rectifier bridge	14	Drive transformer	22	"-" output terminal
7	Fast recovery diode	15	Beam		
8	DC fan	16	Auxiliary power transformer		

### 4.3 Troubleshooting



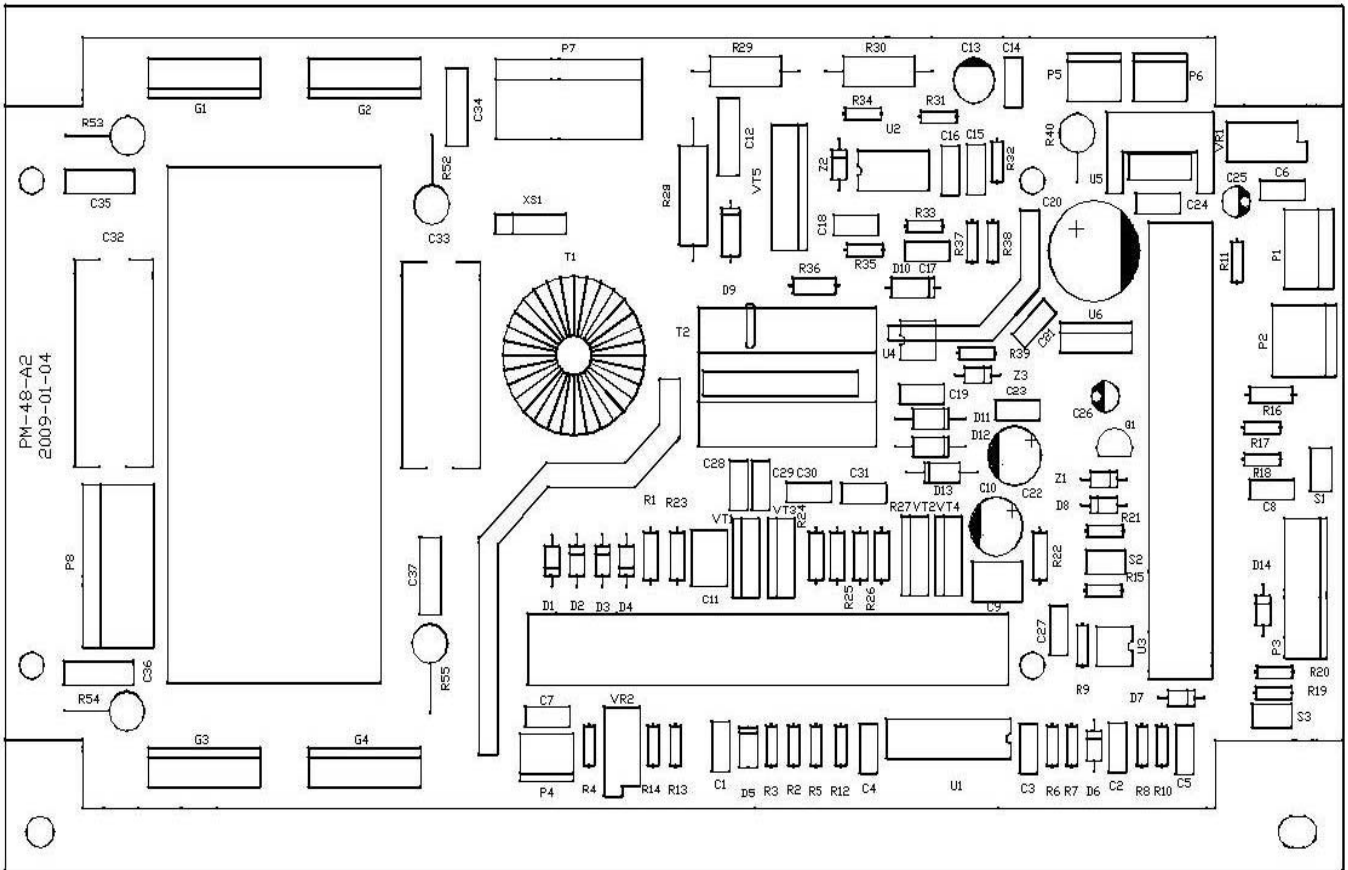
**WARNING:** The following operation requires sufficient professional knowledge on electric aspect and comprehensive safety knowledge. Operators should be holders of valid qualification certificates which can prove their skills and knowledge. Make sure the input cable of the machine is disconnected from the electricity utility before uncovering the welding machine.

Malfunction phenomena	Cause and solution
<p>The power LED is off, the fan does not work, and there is no welding output.</p>	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal.</li> <li>2. Check if the input cable is well connected to the power switch, and if the power switch can work normally.</li> <li>3. Check if the silicon bridge, IGBT or rectifier diode is damaged, and if the gate resistor of IGBT is burned. Replace them if necessary.</li> <li>4. Check if there is DC 310V with the digital multimeter. If there is, replace the control PCB (the top PCB of ARC140 PM-48-A2; the top PCB of ARC160/ARC170 PM-45-A2; the top PCB of ARC180 PM-49-A2). Otherwise, replace the rectifier filter PCB (the bottom PCB of ARC140/ARC160/ARC170 PZ-73-A3; the bottom PCB of ARC180 PZ-88-A0).</li> </ol>
<p>The fan works, but the output current during welding is unstable and can not be controlled by the potentiometer.</p>	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal.</li> <li>2. Check if the connecting wires on the control PCB are well connected.</li> <li>3. Check if the current potentiometer is damaged, and replace it if necessary.</li> <li>4. Replace the control PCB (the top PCB of ARC140 PM-48-A2; the top PCB of ARC160/ARC170 PM-45-A2; the top PCB of ARC180 PM-49-A2). If the problem remains, replace the rectifier PCB (the bottom PCB of ARC140/ARC160/ ARC170 PZ-73-A3; the bottom PCB of ARC180 PZ-88-A0).</li> </ol>
<p>The power LED is on, the fan works, but there is no welding output.</p>	<ol style="list-style-type: none"> <li>1. Check if the connecting wires on all PCBs are well connected.</li> <li>2. The output terminal is not well connected.</li> <li>3. The protection LED is on: Pull the thermal switch out, and check if the protection LED is still on. If it is off, it indicates that overheating protection occurs. Otherwise, replace the control PCB. If the machine is under overheating protection status, it can recover automatically after the welding machine is cooled.</li> <li>4. The protection LED is off: Check if there is no-load voltage (in ARC mode, about 67V for ARC140/ARC160 and about 76V for ARC170/ARC180). If no no-load voltage, pull out the thermal switch and voltage feedback wire on the control PCB, and check again. If there is still no no-load voltage, check if there is about 8.4V with the black probe connected to the ground (metal part) of 7815 and the red probe connected to the drain (metal part) of IRF9Z24 or IRFZ24. If there is, replace the center PCB (PD-47-A2 for ARC140; PD-54-A1 for ARC160/ARC170/ARC180). Otherwise, replace the control PCB (the top PCB PM-48-A2 for ARC140; the top PCB PM-45-A2 for ARC160/ARC170; the top PCB PM-49-A2 for ARC180).</li> </ol>

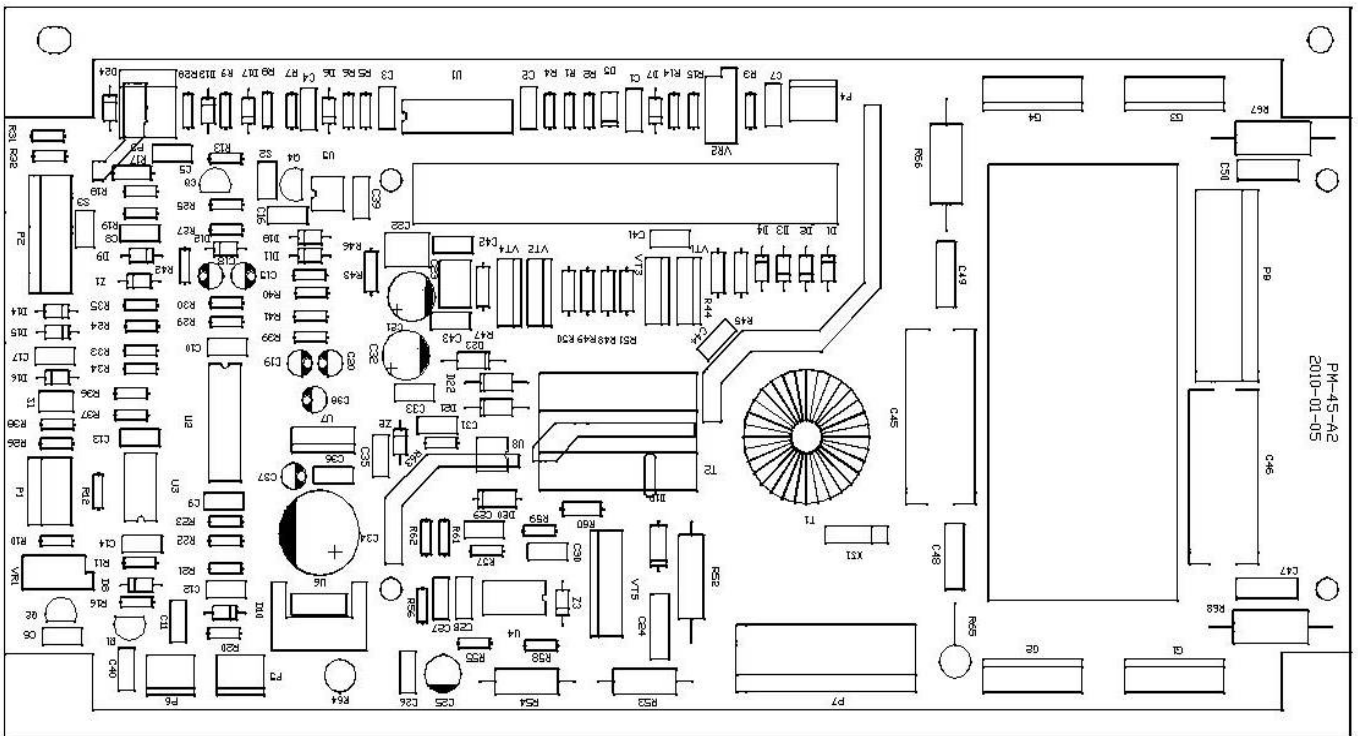
VRD is unavailable in MMA.	<ol style="list-style-type: none"> <li>1. Check the ARC/VRD switch for damage, and if the connecting wire to the control PCB (the top PCB of ARC140 PM-48-A2; the top PCB of ARC160/ARC170 PM-45-A2; the top PCB of ARC180 PM-49-A2) is well connected.</li> <li>2. If the problem remains, replace the control PCB.</li> </ol> <p>Note: VRD is unavailable for some of the models.</p>
Anti-sticking function is unavailable during welding.	<ol style="list-style-type: none"> <li>1. Check if the voltage feedback wire and current feedback wire are well connected.</li> <li>2. Replace the control PCB (the top PCB of ARC140 PM-48-A2; the top PCB of ARC160/ARC170 PM-45-A2; the top PCB of ARC180 PM-49-A2).</li> </ol>
Lift arc function is unavailable.	<ol style="list-style-type: none"> <li>1. Check if the voltage feedback wire and current feedback wire are well connected.</li> <li>2. Replace the control PCB (the top PCB of ARC140 PM-48-A2; the top PCB of ARC160/ARC170 PM-45-A2; the top PCB of ARC180 PM-49-A2).</li> </ol>
Arc is hard to ignite in TIG.	<ol style="list-style-type: none"> <li>1. Check if the argon gas is normally connected, and if the gas pressure is high enough. Replace the cylinder if necessary.</li> <li>2. Check if the electrode is oxidized, and polish it if necessary.</li> <li>3. Check if the workpiece surface is rusty, and if there are any foreign matters on the workpiece surface. Clean the workpiece if necessary.</li> <li>4. Check if the mains voltage is normal.</li> <li>5. Check if the lift arc switch is damaged.</li> <li>6. Replace the control PCB (the top PCB of ARC140 PM-48-A2; the top PCB of ARC160/ARC170 PM-45-A2; the top PCB of ARC180 PM-49-A2).</li> </ol>
The electrode holder becomes very hot.	The rated current of the electrode holder is lower than its actual working current. Replace it with a higher rated current.
Excessive spatter in MMA welding.	The output polarity connection is incorrect. Exchange the polarity.

## 4.4 Appendix

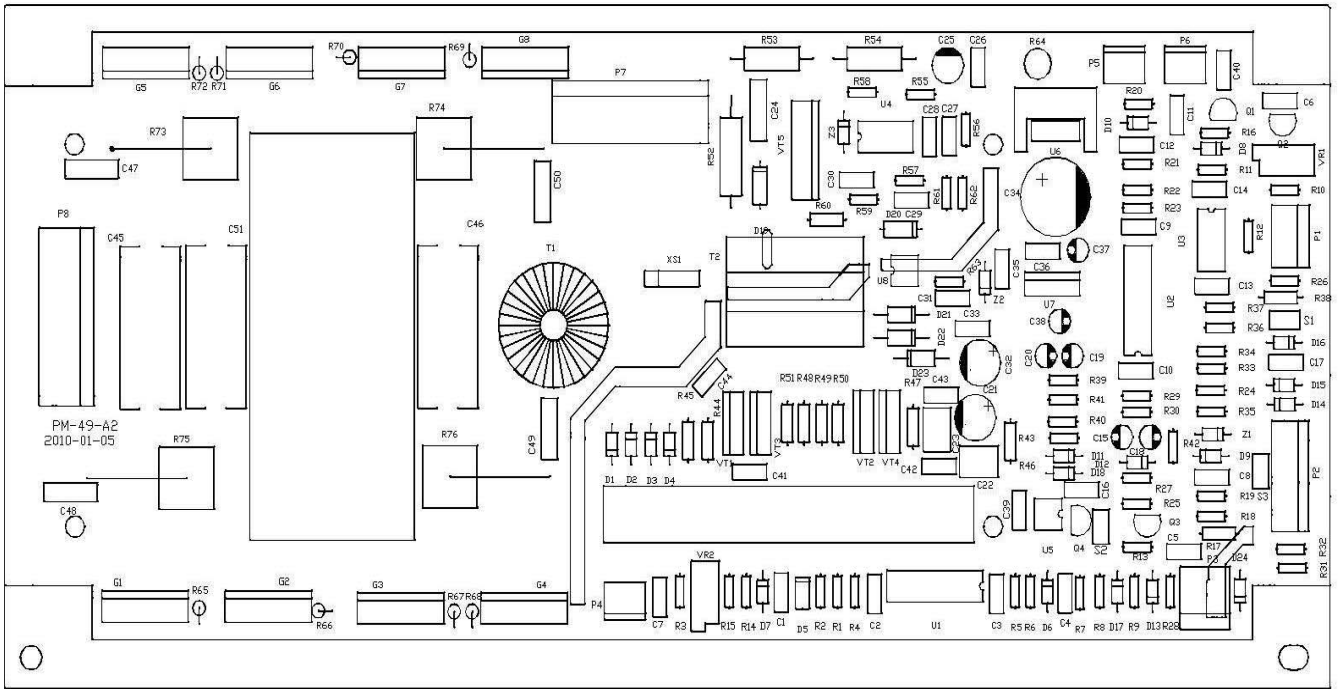
### 1) Bare PCB diagrams



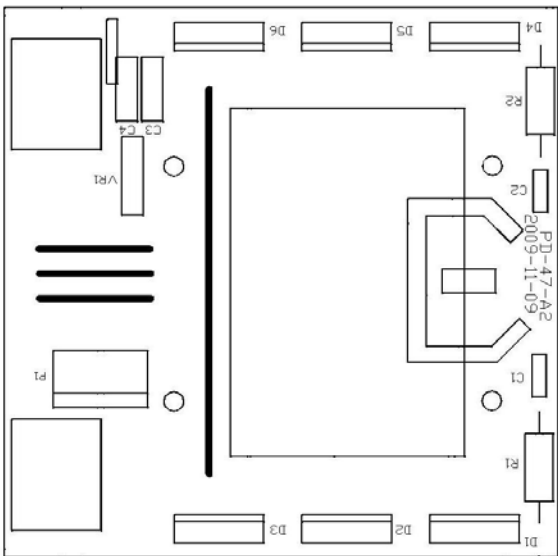
PM-48-A2 (top PCB of ARC140)



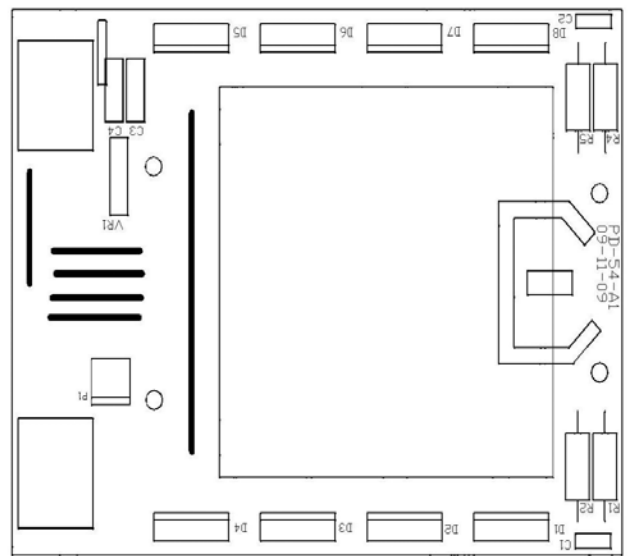
PM-45-A2 (top PCB of ARC160/ARC170)



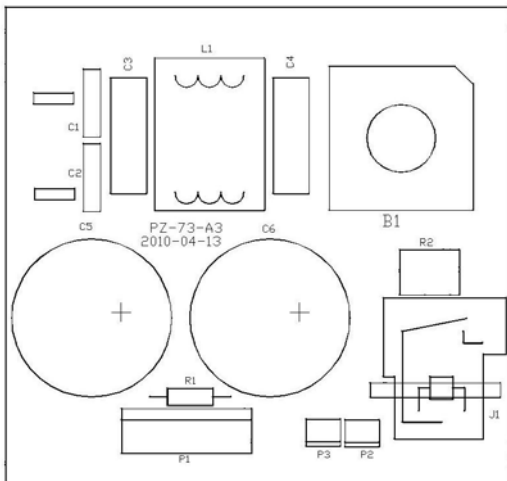
**PM-49-A2 (top PCB of ARC180)**



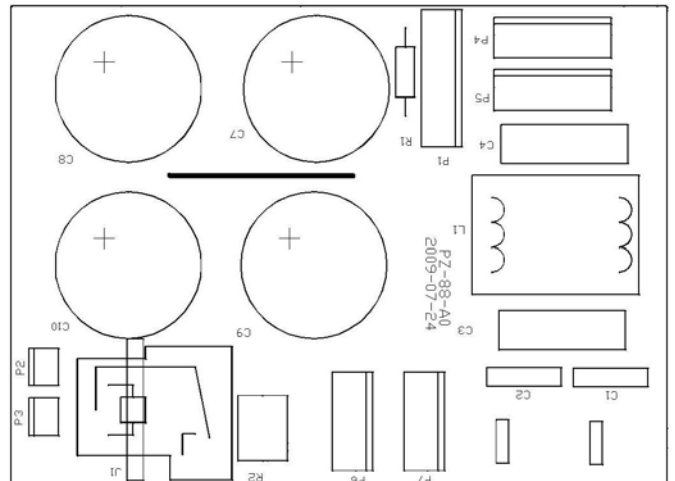
**PD-47-A2 (center PCB of ARC140)**



**PD-54-A1 (center PCB of ARC160/ARC170/ARC180)**



**PZ-73-A3 (bottom PCB of ARC140/ARC160/ARC170)**



**PZ-88-A0 (bottom PCB of ARC180)**

## 2) Test data for chip pins

Tested machine: ARC140/ARC160/ARC170/ARC180							
Tested chip (U1 on PWM control module): KA3846							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	6.0K	6.0K	2.5V	9	3.91K	3.91K	
2	4.2K	4.2K	5V	10	12.56K	12.56K	
3	0.0Ω	0.0Ω	0V	11	1.99M	18.54M	
4	116.5Ω	116.5Ω		12	0.0Ω	0.0Ω	
5	15.16M	∞		13	900Ω	900Ω	
6	12.85M	∞		14	13.13M	18.58M	
7	12.85M	∞		15	900Ω	900Ω	15V
8	13.20M	∞		16	75Ω	75Ω	

**Note: Do not test pin-4 and pin-5 of KA3846 with the multimeter when it is electrified.**

Tested machine: ARC140/ARC160/ARC170/ARC180							
Tested chip (U2 on PWM control module): TL084							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	22.9K	22.9K	12.31V	8	1.11K	1.11K	
2	59.2K	59.2K		9	1.11K	1.11K	
3	0.0Ω	0.0Ω		10	13.15M	∞	
4	900Ω	900Ω	15V	11	6.51K	6.51K	-15V
5	4.1K	4.1K		12	9.85K	10K	
6	2.6K	2.6K	5.4V	13	15.13M	∞	
7	∞	3.04M		14	15M	∞	

Tested machine: ARC140							
Tested chip (U1 on the top PCB): TL084							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	∞	∞		8	466K	466K	
2	33.6K	33.6K	0.77V	9	466K	466K	
3	98K	83.6K		10	3.37K	3.37K	
4	1K	1K	15V	11	8.11K	8.03K	-15V
5	Grounded	Grounded		12	9.98K	9.98K	
6	Grounded	Grounded		13	1K	1K	
7	∞	∞		14	30.5K	30.5K	

Tested machine: ARC140							
Tested chip (U1 on the functional module): LM324							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	14.95K	∞		8	17.87M	∞	
2	14.95K	33.6K	0.88V	9	∞	∞	
3	18.68K	83.6K		10	27.4K	27.4K	0.68V
4	857 Ω	857 Ω	15V	11	5.7K	5.7K	-15V
5	3.26K	3.26K		12	∞	∞	7.4V
6	14.95M	18.7M		13	∞	∞	
7	14.95M	18.7M		14	17.78M	∞	

Tested machine: ARC160/ARC170/ARC180							
Tested chip (U1 on the top PCB): TL084							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	∞	∞		8	466K	466K	
2	33.6K	33.6K		9	466K	466K	
3	98K	83.6K		10	3.37K	3.37K	
4	1K	1K	15V	11	8.11K	8.03K	-15V
5	Grounded	Grounded		12	9.98K	9.98K	
6	Grounded	Grounded		13	1K	1K	
7	∞	∞		14	30.5K	30.5K	

Tested machine: ARC160/ARC170/ARC180							
Tested chip (U2 on the top PCB): LM324							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	14.95K			8	17.87M	∞	
2	14.95K	33.6K		9	∞	∞	
3	18.68K	83.6K		10	27.4K	27.4K	
4	857 Ω	857 Ω	15V	11	5.7K	5.7K	-15V
5	3.26K	3.26K		12	∞	∞	
6	14.95M	18.7M		13	∞	∞	
7	14.95M	18.7M		14	17.78M	∞	

Tested machine: ARC160/ARC170/ARC180							
Tested chip (U3 on the top PCB): LM358							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	18.1M	$\infty$		5	Grounded	Grounded	
2	14.91M	$\infty$		6	19.2K	19. 2K	
3	3.34K	3.34K	0.68V	7	36.6K	36.6K	
4	5.8K	5.8K	-15V	8	858 $\Omega$	858 $\Omega$	15V

### 3) Spare parts list

No.	Part number	Part name
1	D24050	IGBT-FGH40N60 (ARC140)
	D24053	IGBT-FGH60N60 (ARC160/ARC170)
	D24058	IGBT-FGH20N60 (ARC180)
2	RSD04025	Rectifier diode D92-02
3	D02387	Electrolytic capacitor CD-470uF-400V
4	D01252	Cement resistor SQM-10W-150 $\Omega$
5	D19049	IC KA3846
6	D19003	IC UC3843BN(ON)
7	D19026	IC TL084
8	D05109	NMOS transistor IRFZ24N
9	D05112	PMOS transistor IRF9Z24N
10	RSD05113	High-power MOS transistor 2SK2611
11	D03597	Auxiliary power transformer HS21318/01(200:16:33:33)
12	D04029	Rectifier diode UF4004
13	D18001	Silicon bridge S35VB100
14	D19011	Zener diode KA7815
15	D15101	Carbon film potentiometer WH30P-B1K-20/3

### 5. Single-phase inverter welder ARC200

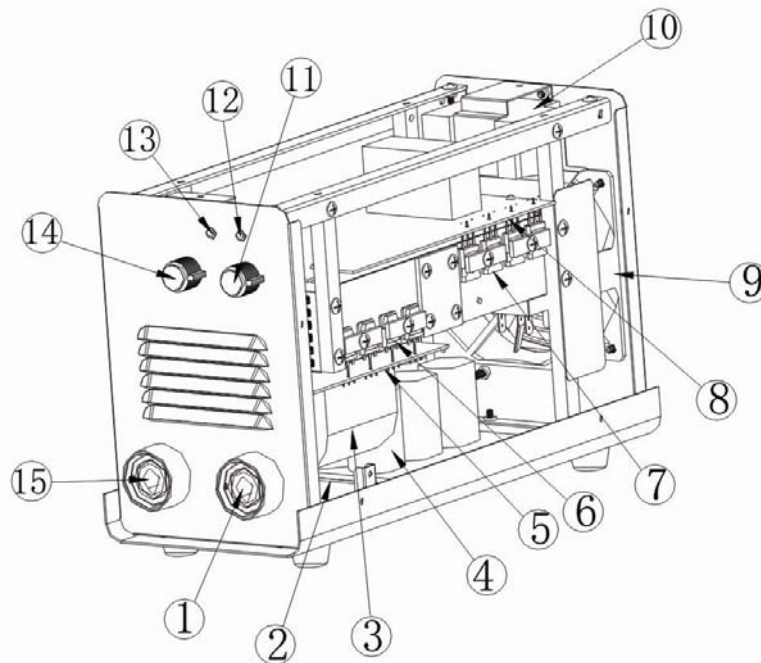




## 5.1 Main technical parameters

<b>Model</b>	<b>ARC200</b>
Rated input voltage (V)	AC230V ± 15%, 50/60Hz
Rated input power (KVA)	9.4
Rated output	200A/28V
Welding current range (A)	10~140A
No-load voltage (V)	76
Rated duty cycle	60%
Efficiency (%)	85
Power factor	0.7
Protection class	IP21
Insulation class	F
Overall size (mm)	372×220×150
Weight (Kg)	8.2

## 5.2 Machine structure



No.	Part name	No.	Part name
1	"-" output terminal	9	AC 220V fan
2	Bottom PCB	10	Power switch
3	Main transformer	11	Current potentiometer
4	Electrolytic capacitor	12	Overcurrent LED
5	Center PCB	13	Power LED
6	Fast recovery diode	14	Arc force potentiometer
7	IGBT	15	"+" output terminal
8	Top PCB		

## 5.3 Troubleshooting



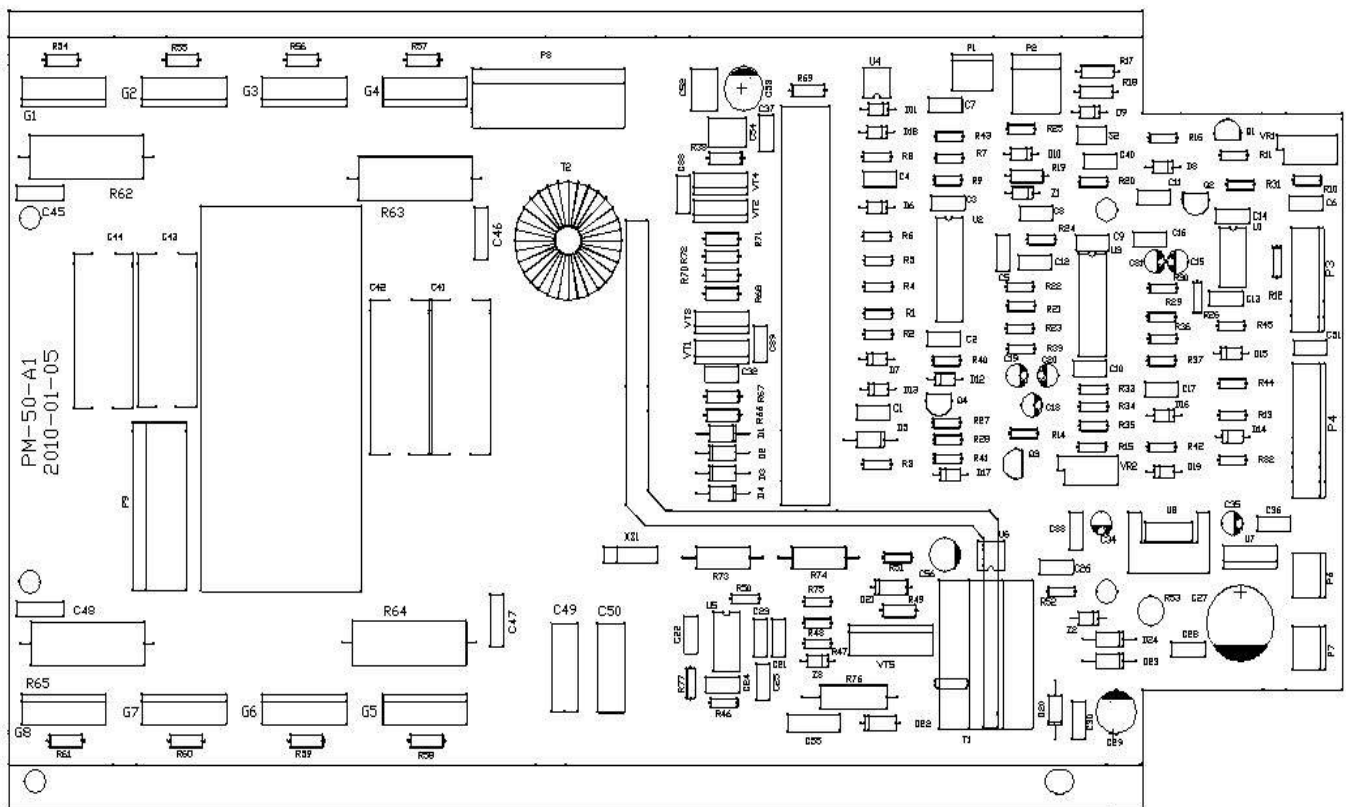
**WARNING:** The following operation requires sufficient professional knowledge on electric aspect and comprehensive safety knowledge. Operators should be holders of valid qualification certificates which can prove their skills and knowledge. Make sure the input cable of the machine is disconnected from the electricity utility before uncovering the welding machine.

Malfunction phenomena	Cause and solution
<p>The power LED is off, the meter does not display, the fan does not work, and there is no welding output.</p>	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal.</li> <li>2. Check if the input cable is well connected to the power switch, and if the power switch can work normally.</li> <li>3. Check if the silicon bridge, IGBT or rectifier diode is damaged, and if the gate resistor of IGBT is burned. Replace them if necessary.</li> <li>4. Check if there is DC 310V with the digital multimeter. If there is, replace the control PCB PM-50-A1 (the top PCB). Otherwise, replace the rectifier filter PCB (the bottom PCB).</li> </ol>
<p>The fan works, but the output current during welding is unstable and can not be controlled by the potentiometer.</p>	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal.</li> <li>2. Check if the connecting wires on the control PCB PM-50-A1 are well connected.</li> <li>3. Check if the current potentiometer is damaged, and if the meter display can be normally adjusted. Replace the potentiometer if necessary.</li> <li>4. Replace the control PCB PM-50-A1. If the problem remains, replace the bottom PCB PZ-87-A0.</li> </ol>
<p>The power LED is on, the fan works, the meter displays normally, but there is no welding output.</p>	<ol style="list-style-type: none"> <li>1. Check if the connecting wires on all PCBs are well connected.</li> <li>2. The output terminal is not well connected.</li> <li>3. The protection LED is on: Pull the thermal switch out, and check if the protection LED is still on. If it is off, it indicates that overheating protection occurs. Otherwise, replace the control PCB. If the machine is under overheating protection status, it can recover automatically after the welding machine is cooled.</li> <li>4. The protection LED is off: Check if there is no-load voltage (about 76V for ARC200). If no no-load voltage, pull out the thermal switch and voltage feedback wire (P2) on the control PCB PM-50-A1, and check again. If there is still no no-load voltage, check if there is about 8.4V with the black probe connected to the ground (metal part) of 7815 and the red probe connected to the drain (metal part) of IRF9Z24 or IRFZ24. If there is, replace the center PCB PD-53-A0. Otherwise, replace the control PCB PM-50-A1 (the top PCB).</li> </ol>
<p>VRD is unavailable in MMA.</p>	<ol style="list-style-type: none"> <li>1. Check the ARC/VRD switch for damage, and if the connecting wire to the control PCB PM-50-A1 is well connected.</li> <li>2. If the problem remains, replace the control PCB PM-50-A1.</li> </ol> <p>Note: VRD is unavailable for some of the models.</p>
<p>The meter display is abnormal.</p>	<ol style="list-style-type: none"> <li>1. Replace the meter.</li> <li>2. If the problem remains, replace the control PCB PM-50-A1.</li> </ol>

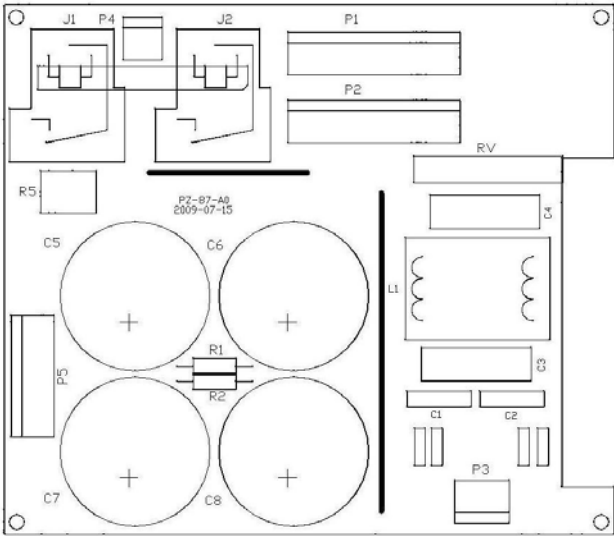
Anti-sticking function is unavailable during welding.	<ol style="list-style-type: none"> <li>1. Check if the voltage feedback wire and current feedback wire are well connected.</li> <li>2. Replace the control PCB PM-50-A1.</li> </ol>
Lift arc function is unavailable.	<ol style="list-style-type: none"> <li>1. Check if the voltage feedback wire and current feedback wire are well connected.</li> <li>2. Replace the control PCB PM-50-A1.</li> </ol>
Arc is hard to ignite in TIG.	<ol style="list-style-type: none"> <li>1. Check if the argon gas is normally connected, and if the gas pressure is high enough. Replace the cylinder if necessary.</li> <li>2. Check if the electrode is oxidized, and polish it if necessary.</li> <li>3. Check if the workpiece surface is rusty, and if there are any foreign matters on the workpiece surface. Clean the workpiece if necessary.</li> <li>4. Check if the mains voltage is normal.</li> <li>5. Check if the lift arc switch is damaged.</li> <li>6. Replace the control PCB PM-50-A1.</li> </ol>
There is no arc force.	<ol style="list-style-type: none"> <li>1. Check if the voltage feedback wire, current feedback wire and the arc force potentiometer wire are well connected.</li> <li>2. Replace the control PCB PM-50-A1.</li> </ol>
The electrode holder becomes very hot.	The rated current of the electrode holder is lower than its actual working current. Replace it with a higher rated current.
Excessive spatter in MMA welding.	The output polarity connection is incorrect. Exchange the polarity.

## 5.4 Appendix

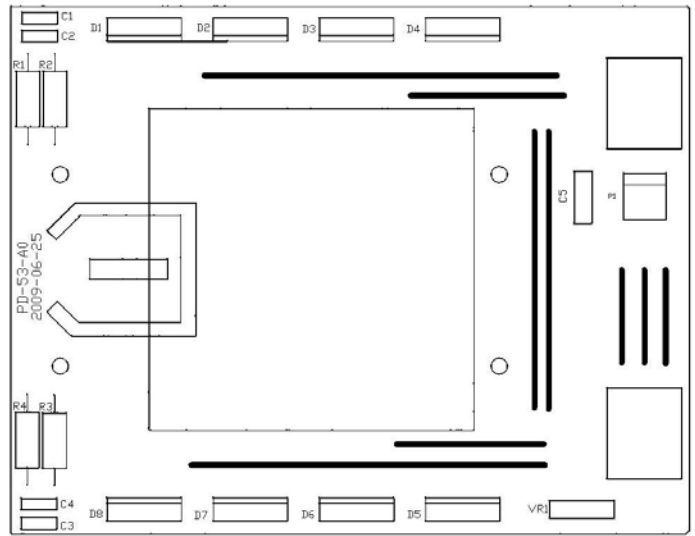
### 1) Bare PCB diagrams



PM-50-A1 (top PCB of ARC200)



**PZ-87-A0 (bottom PCB of ARC200)**



Tested machine: ARC200							
Tested chip (U1 on the top PCB): TL084							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	∞	∞		8	466K	466K	
2	33.6K	33.6K	8.8V	9	466K	466K	
3	98K	83.6K		10	3.37K	3.37K	
4	1K	1K	15V	11	8.11K	8.03K	-15V
5	Grounded	Grounded		12	9.98K	9.98K	
6	Grounded	Grounded		13	1K	1K	
7	∞	∞		14	30.5K	30.5K	

Tested machine: ARC200							
Tested chip (U2 on the top PCB): LM324							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	14.95K			8	17.87M	∞	
2	14.95K	33.6K		9	∞	∞	
3	18.68K	83.6K	1.6V	10	27.4K	27.4K	
4	857 Ω	857 Ω	15V	11	5.7K	5.7K	-15V
5	3.26K	3.26K		12	∞	∞	
6	14.95M	18.7M		13	∞	∞	
7	14.95M	18.7M		14	17.78M	∞	

Tested machine: ARC200							
Tested chip (IC3 on the top PCB): LM358							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	18.1M	∞		5	Grounded	Grounded	
2	14.91M	∞		6	19.2K	19.2K	
3	3.34K	3.34K		7	36.6K	36.6K	
4	5.8K	5.8K		8	858 Ω	858 Ω	15V

### 3) Spare parts list

No.	Part number	Part name
1	D24050	IGBT-FGH40N60
2	RSD04025	Rectifier diode D92-02
3	D02387	Electrolytic capacitor CD-470uF-400V
4	D01252	Cement resistor SQM-10W-150 $\Omega$
5	D19049	IC KA3846
6	D19003	IC UC3843BN(ON)
7	D19026	IC TL084
8	D05109	NMOS transistor IRFZ24N
9	D05112	PMOS transistor IRF9Z24N
10	RSD05113	High-power MOS transistor 2SK2611
11	D03597	Auxiliary power transformer HS21318/01(200:16:33:33)
12	D04029	Rectifier diode UF4004
13	D18203	Silicon bridge GBPC5010
14	D19011	Zener diode KA7815
15	D15101	Carbon film potentiometer WH30P-B1K-20/3

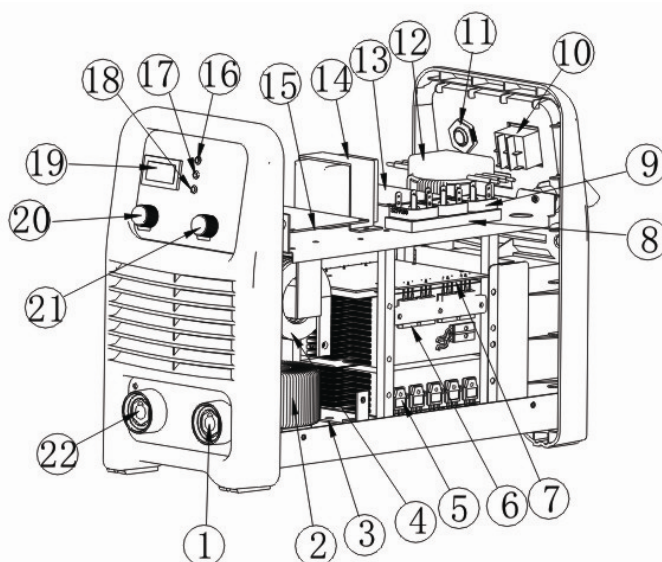
### 6. Three-phase inverter welder ARC220/ARC250



## 6.1 Main technical parameters

Model	ARC220	ARC250
Rated input voltage (V)	AC380V±15%, 50/60Hz	
Rated input power (KVA)	7.2	9.2
Rated output	220A/28.8V	250A/30V
Welding current range (A)	10~140A	10~140A
No-load voltage (V)	56	65
Rated duty cycle	40%@40°C	40%@40°C
Efficiency (%)	88	85
Power factor	0.95	0.96
Protection class	IP21	IP21
Insulation class	F	F
Overall size (mm)	450×160×385	450×160×385
Weight (Kg)	13.5	13.5

## 6.2 Machine structure



No.	Part name	No.	Part name	No.	Part name
1	"-" output terminal	9	Silicon bridge	17	Overheating LED
2	Main transformer	10	3-phase AC switch	18	Overcurrent LED
3	Rectifier PCB	11	Buckle for 3-phase power cord	19	Preset current meter
4	Reactor	12	EMC module	20	Arc force potentiometer
5	Fast recovery diode	13	Power conversion board	21	Current potentiometer
6	IGBT	14	Auxiliary power transformer	22	"+" output terminal
7	Inverter PCB	15	Control PCB		
8	Silicon bridge heat sink	16	Power LED		

## 6.3 Troubleshooting



**WARNING:** The following operation requires sufficient professional knowledge on electric aspect and comprehensive safety knowledge. Operators should be holders of valid qualification certificates which can prove their skills and knowledge. Make sure the input cable of the machine is disconnected from the electricity utility before uncovering the welding machine.

Malfunction phenomena	Cause and solution
<p>The power LED is off, the fan does not work, and there is no welding output.</p>	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal, and if phase failure occurs.</li> <li>2. Check if the input cable is well connected to the power switch, and if the power switch can work normally.</li> <li>3. Check if the silicon bridge, IGBT or rectifier diode is damaged, and if the gate resistor of IGBT is burned. Replace them if necessary.</li> <li>4. Pull out the DC power cord (540V, P6) on the rectifier filter PCB, power on the machine, and check if there is about 8.4V with the black probe connected to the ground (metal part) of 7815 and the red probe connected to the drain (metal part) of IRF9Z24 or IRFZ24. If there is no 8.4V, replace the control PCB PK-149-A0.</li> <li>5. If there is 8.4V, insert P6 and power on the machine to check if there is 540V on P6. If there is no 540V, check if the power cord is well connected to the silicon bridge, and if the silicon bridge is well connected to P6. Otherwise, replace the inverter PCB PN-40-A0.</li> <li>6. Check if there is no-load voltage (about 56V for ARC220 and about 65V for ARC250). If there is, welding can be carried out normally. Otherwise, replace the secondary rectifier PCB PD-55-A0.</li> </ol>
<p>The fan works, but the output current during welding is unstable and can not be controlled by the potentiometer.</p>	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal, and if phase failure occurs.</li> <li>2. Check if the connecting wires on the control PCB PM-149-A0 are well connected.</li> <li>3. Check if the current potentiometer is damaged, and if the meter display can be normally adjusted. Replace the potentiometer if necessary.</li> <li>4. Replace the control PCB PM-149-A0.</li> </ol>

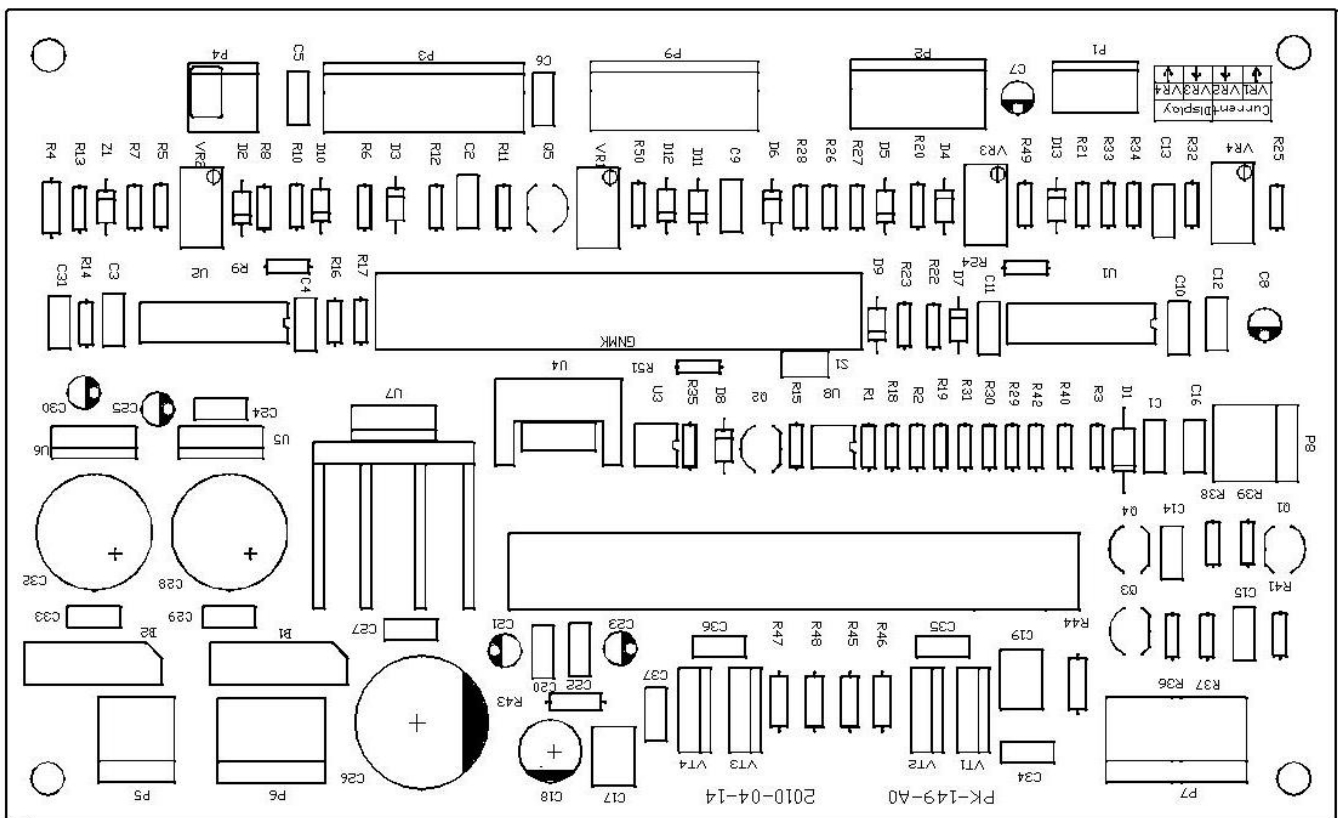


<p>The power LED is on, the fan works, the meter displays normally, but there is no welding output.</p>	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal, and if phase failure occurs.</li> <li>2. Check if the connecting wires on the control PCB PM-149-A0 are well connected.</li> <li>3. The output terminal is not well connected.</li> <li>4. The protection LED is on: Pull the thermal switch out, and check if the protection LED is still on. If it is off, it indicates that overheating protection occurs. Otherwise, it indicates that overcurrent protection occurs. If the machine is under overheating protection status, it can recover automatically after the welding machine is cooled. If the machine is under overcurrent protection status, restart the machine, and check if the protection LED is still on. If it is off, welding can be carried out normally. Otherwise, pull out the input wire (P6) of the main transformer, and restart the machine to check if the protection LED is still on. If it is on, replace the inverter PCB PN-40-A0. Otherwise, replace the secondary rectifier PCB PD-55-A0.</li> <li>5. The protection LED is off: Check if there is no-load voltage (about 56V for ARC220 and about 65V for ARC250). If no no-load voltage, pull out the thermal switch and voltage feedback wire (P4) on the control PCB PK-149-A0, and check again. If there is still no no-load voltage, check if there is about 8.4V with the black probe connected to the ground (metal part) of 7815 and the red probe connected to the drain (metal part) of IRF9Z24 or IRFZ24. If there is, replace the secondary rectifier PCB PD-55-A0. Otherwise, replace the control PCB PK-149-A0.</li> </ol>
<p>VRD is unavailable in MMA.</p>	<ol style="list-style-type: none"> <li>1. Check the ARC/VRD switch for damage, and if the connecting wire to the control PCB PM-149-A0 is well connected.</li> <li>2. If the problem remains, replace the control PCB PM-149-A0.</li> </ol> <p>Note: VRD is unavailable for some of the models.</p>
<p>The meter display is abnormal.</p>	<ol style="list-style-type: none"> <li>1. Replace the meter.</li> <li>2. If the problem remains, replace the control PCB PM-149-A0.</li> </ol>
<p>Anti-sticking function is unavailable during welding.</p>	<ol style="list-style-type: none"> <li>1. Check if the voltage feedback wire and current feedback wire are well connected.</li> <li>2. Replace the control PCB PM-149-A0.</li> </ol>
<p>Lift arc function is unavailable.</p>	<ol style="list-style-type: none"> <li>1. Check if the voltage feedback wire and current feedback wire are well connected, and if the lift arc switch is damaged.</li> <li>2. Replace the control PCB PM-149-A0.</li> </ol>
<p>Arc is hard to ignite in TIG.</p>	<ol style="list-style-type: none"> <li>1. Check if the argon gas is normally connected, and if the gas pressure is high enough. Replace the cylinder if necessary.</li> <li>2. Check if the electrode is oxidized, and polish it if necessary.</li> <li>3. Check if the workpiece surface is rusty, and if there are any foreign matters on the workpiece surface. Clean the workpiece if necessary.</li> <li>4. Check if the mains voltage is normal.</li> <li>5. Check if the lift arc switch is damaged.</li> <li>6. Replace the control PCB PM-149-A0.</li> </ol>
<p>There is no arc force.</p>	<ol style="list-style-type: none"> <li>1. Check if the voltage feedback wire, current feedback wire and the arc force potentiometer wire are well connected.</li> <li>2. Replace the control PCB PM-149-A0.</li> </ol>

The meter does not display.	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal, and if phase failure occurs.</li> <li>2. Check if the input cable is well connected to the power switch, and if the power switch can work normally.</li> <li>3. Check if the silicon bridge, IGBT or rectifier diode is damaged, and if the gate resistor of IGBT is burned. Replace them if necessary.</li> <li>4. Check if the auxiliary power transformer on control PCB PM-149-A0 works normally. If it does, replace the control PCB PM-149-A0. Otherwise, replace the auxiliary power transformer. If the problem remains, replace the meter.</li> </ol>
The electrode holder becomes very hot.	The rated current of the electrode holder is lower than its actual working current. Replace it with a higher rated current.
Excessive spatter in MMA welding.	The output polarity connection is incorrect. Exchange the polarity.

## 6.4 Appendix

### 1) Bare PCB diagrams



**PK-149-A0 (control PCB of ARC220/ARC250/ARC315)**



Tested machine: ARC220/ARC250/ARC315							
Tested chip (U2 on PWM control module): TL084							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	23K	23K	12.31V	8	1. 11K	1. 11K	
2	138.8K	126.2K		9	1. 11K	1. 11K	
3	Grounded	Grounded		10	∞	∞	
4	878 Ω	878 Ω	15V	11	8.19K	8.19K	-15V
5	4.24K	4.24K		12	10K	10K	
6	2.58K	2.58K	5.4V	13	15.06M	∞	
7	∞	130K		14	15M	∞	

Tested machine: ARC220/ARC250/ARC315							
Tested chip (U2 on the top PCB): TL084							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	725K	∞		8	30.8K	30.8K	
2	9K	9K	8.8V	9	982	982	
3	84.5K	99.3K		10	10.34K	10.34K	
4	877	877	15V	11	8.11K	8.2K	-15V
5	Grounded	Grounded		12	3.51K	3.51K	
6	12.67K	12.67K		13	739K	182.7K	
7	10.44K	10.44K		14	739K	182.7K	

Tested machine: ARC220/ARC250/ARC315							
Tested chip (U1 on the top PCB): LM324							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	14.42M	18.7M		8	28.9K	28.9K	
2	14.82M	18.7M		9	42K	42K	
3	2.9K	2.9K	1.6V	10	Grounded	Grounded	
4	875 Ω	875 Ω	15V	11	8.21K	8.21K	-15V
5	10K	10K		12	Grounded	Grounded	
6	14.85M	18.7M		13	2.68M	645K	
7	14.85M	18.7M		14	2.66M	645K	

Tested machine: ARC220/ARC250/ARC315							
Tested chip (U1 on the functional module): LM324							
Test data: Working voltage, working resistance							
Pin	Working resistance		Working voltage	Pin	Working resistance		Working voltage
	Red probe grounded	Black probe grounded	Working state		Red probe grounded	Black probe grounded	Working state
1	14.95K	∞		8	17.87M	∞	
2	14.95K	33.6K	0.88V	9	∞	∞	
3	18.68K	83.6K		10	27.4K	27.4K	0.68V
4	857 Ω	857 Ω	15V	11	5.7K	5.7K	-15V
5	3.26K	3.26K		12	∞	∞	7.4V
6	14.95M	18.7M		13	∞	∞	
7	14.95M	18.7M		14	17.78M	∞	

### 3) Spare parts list

No.	Part number	Part name
1	D24061 D24015	IGBT-FGA25N120ANTD (ARC220) IGBT-FGL60N100BNTD (ARC250)
2	RSD04025	Rectifier diode D92-02
3	D02387	Capacitor CBB21-B-800V-10uF-K
4	D19049	IC KA3846
5	D19026	IC TL084
6	D05109	NMOS transistor IRFZ24N
7	D05112	PMOS transistor IRF9Z24N
8	D03536	Power transformer (Primary: 5V3-110; Secondary: 3V2/2V2-110)
9	D04029	Rectifier diode UF4004
10	D18300	S25VB100 (original)
11	D19011	Zener diode KA7815
12	D15101	Carbon film potentiometer WH30P-B1K-20/3

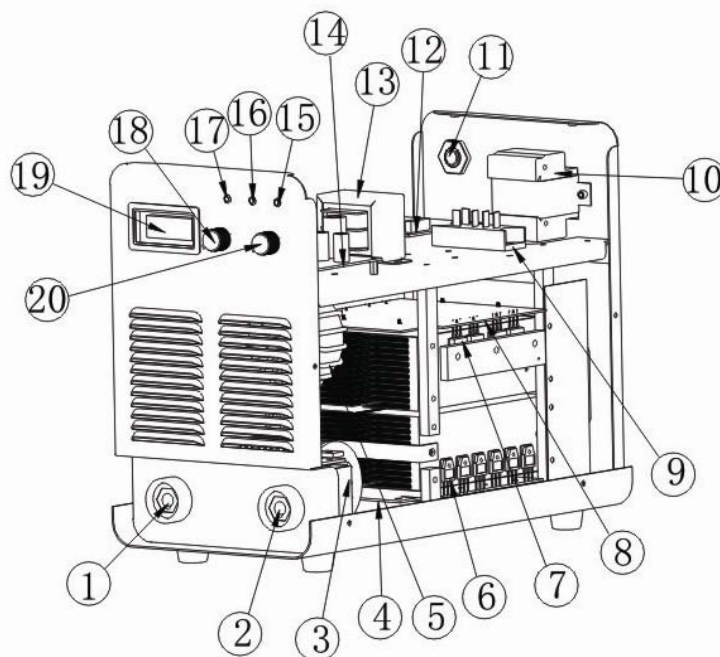
## 7. Three-phase inverter welder ARC315



## 7.1 Main technical parameters

<b>Model</b>	<b>ARC315</b>
Rated input voltage (V)	AC380V ± 15%, 50/60Hz
Rated input power (KVA)	7.2
Rated output	315A/32.6V
Welding current range (A)	20~315A
No-load voltage (V)	56
Rated duty cycle	60%@40°C
Efficiency (%)	88
Power factor	0.95
Protection class	IP21
Insulation class	F
Overall size (mm)	460×230×410
Weight (Kg)	19

## 7.2 Machine structure



No.	Part name	No.	Part name	No.	Part name
1	“+” output terminal	8	Inverter PCB	15	Overcurrent LED
2	“-” output terminal	9	Silicon bridge	16	Overheating LED
3	Reactor	10	Power switch	17	Power LED
4	Rectifier PCB	11	Buckle for 3-phase power cord	18	Preset current meter
5	Main transformer	12	Power conversion board	19	Arc force potentiometer
6	Fast recovery diode	13	Auxiliary power transformer	20	Current potentiometer
7	IGBT	14	Control PCB		

## 7.3 Troubleshooting



**WARNING:** The following operation requires sufficient professional knowledge on electric aspect and comprehensive safety knowledge. Operators should be holders of valid qualification certificates which can prove their skills and knowledge. Make sure the input cable of the machine is disconnected from the electricity utility before uncovering the welding machine.

Malfunction phenomena	Cause and solution
<p>The power LED is off, the meter does not display, the fan does not work, and there is no welding output.</p>	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal, and if phase failure occurs.</li> <li>2. Check if the input cable is well connected to the power switch, and if the power switch can work normally.</li> <li>3. Check if the silicon bridge, IGBT or rectifier diode is damaged, and if the gate resistor of IGBT is burned. Replace them if necessary.</li> <li>4. Pull out the DC power cord (540V, P1 on the inverter PCB) on the rectifier filter PCB, power on the machine, and check if there is about 8.4V with the black probe connected to the ground (metal part) of 7815 and the red probe connected to the drain (metal part) of IRF9Z24 or IRFZ24. If there is no 8.4V, replace the control PCB PK-149-A0.</li> <li>5. If there is 8.4V, insert P1 and power on the machine to check if there is 540V on P1. If there is no 540V, check if the power cord is well connected to the silicon bridge, and if the silicon bridge is well connected to P1. Otherwise, replace the inverter PCB PN-40-A0.</li> <li>6. Check if there is no-load voltage (about 65V for ARC315). If there is, welding can be carried out normally. Otherwise, replace the secondary rectifier PCB PD-58-A0.</li> </ol>
<p>The fan works, but the output current during welding is unstable and can not be controlled by the potentiometer.</p>	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal, and if phase failure occurs.</li> <li>2. Check if the connecting wires on the control PCB PM-149-A0 are well connected.</li> <li>3. Check if the current potentiometer is damaged, and if the meter display can be normally adjusted. Replace the potentiometer if necessary.</li> <li>4. Replace the control PCB PM-149-A0.</li> </ol>

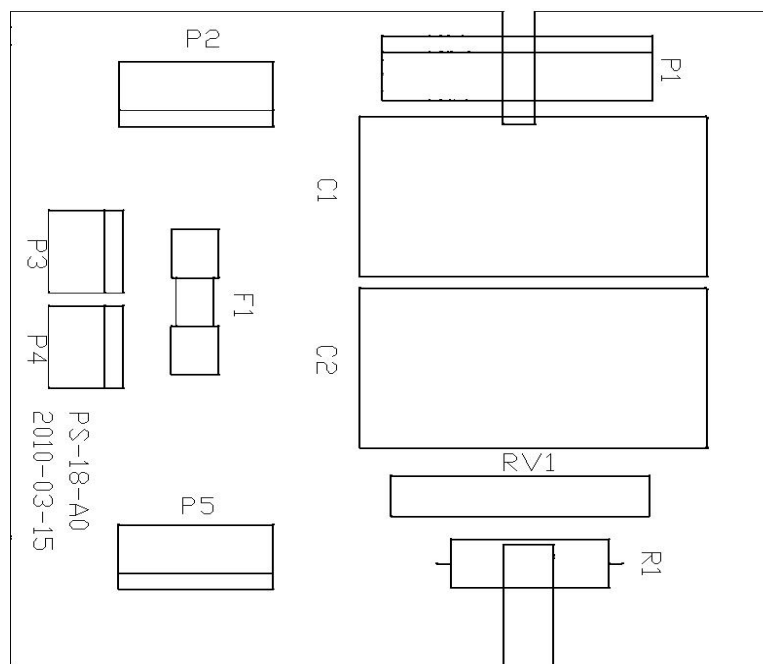
<p>The power LED is on, the fan works, the meter displays normally, but there is no welding output.</p>	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal, and if phase failure occurs.</li> <li>2. Check if the connecting wires on the control PCB PM-149-A0 are well connected.</li> <li>3. The output terminal is not well connected.</li> <li>4. The protection LED is on: Pull the thermal switch out, and check if the protection LED is still on. If it is off, it indicates that overheating protection occurs. Otherwise, it indicates that overcurrent protection occurs. If the machine is under overheating protection status, it can recover automatically after the welding machine is cooled. If the machine is under overcurrent protection status, restart the machine, and check if the protection LED is still on. If it is off, welding can be carried out normally. Otherwise, pull out the input wire (P3 on the inverter PCB PN-40-A0) of the main transformer, and restart the machine to check if the protection LED is still on. If it is on, replace the inverter PCB PN-40-A0. Otherwise, replace the secondary rectifier PCB PD-58-A0.</li> <li>5. The protection LED is off: Check if there is no-load voltage (about 65V for ARC315). If no no-load voltage, pull out the thermal switch and voltage feedback wire (P4) on the control PCB PK-149-A0, and check again. If there is still no no-load voltage, check if there is about 8.4V with the black probe connected to the ground (metal part) of 7815 and the red probe connected to the drain (metal part) of IRF9Z24 or IRFZ24. If there is, replace the secondary rectifier PCB PD-58-A0. Otherwise, replace the control PCB PK-149-A0.</li> </ol>
<p>VRD is unavailable in MMA.</p>	<ol style="list-style-type: none"> <li>1. Check the ARC/VRD switch for damage, and if the connecting wire to the control PCB PM-149-A0 is well connected.</li> <li>2. If the problem remains, replace the control PCB PM-149-A0.</li> </ol> <p>Note: VRD is unavailable for some of the models.</p>
<p>The meter display is abnormal.</p>	<ol style="list-style-type: none"> <li>1. Check if the mains voltage is normal, and if phase failure occurs.</li> <li>2. Check if the input cable is well connected to the power switch, and if the power switch can work normally.</li> <li>3. Check if the silicon bridge, IGBT or rectifier diode is damaged, and if the gate resistor of IGBT is burned. Replace them if necessary.</li> <li>4. Replace the meter.</li> <li>5. If the problem remains, replace the control PCB PM-149-A0.</li> </ol>
<p>Anti-sticking function is unavailable during welding.</p>	<ol style="list-style-type: none"> <li>1. Check if the voltage feedback wire and current feedback wire are well connected.</li> <li>2. Replace the control PCB PM-149-A0.</li> </ol>
<p>Lift arc function is unavailable.</p>	<ol style="list-style-type: none"> <li>1. Check if the voltage feedback wire and current feedback wire are well connected, and if the lift arc switch is damaged.</li> <li>2. Replace the control PCB PM-149-A0.</li> </ol>



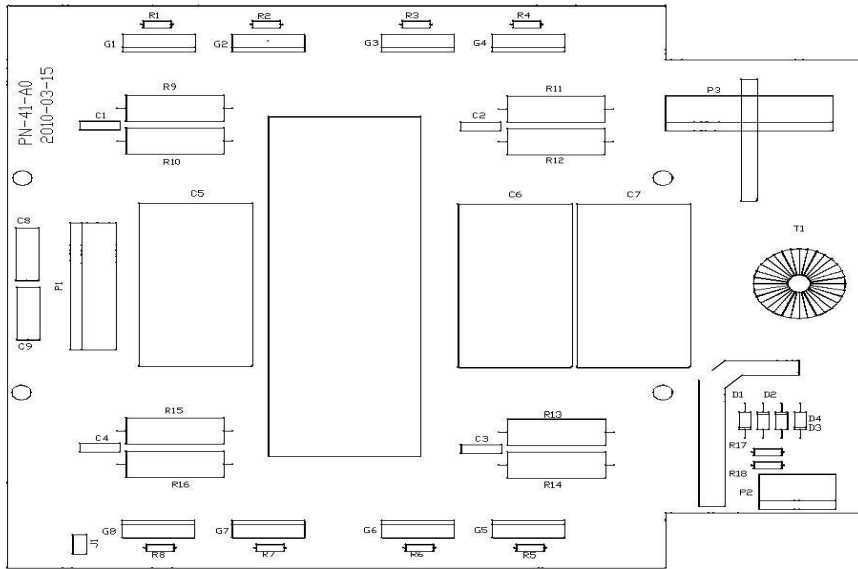
Arc is hard to ignite in TIG.	<ol style="list-style-type: none"> <li>1. Check if the argon gas is normally connected, and if the gas pressure is high enough. Replace the cylinder if necessary.</li> <li>2. Check if the electrode is oxidized, and polish it if necessary.</li> <li>3. Check if the workpiece surface is rusty, and if there are any foreign matters on the workpiece surface. Clean the workpiece if necessary.</li> <li>4. Check if the mains voltage is normal.</li> <li>5. Check if the lift arc switch is damaged.</li> <li>6. Replace the control PCB PM-149-A0.</li> </ol>
There is no arc force.	<ol style="list-style-type: none"> <li>1. Check if the voltage feedback wire, current feedback wire and the arc force potentiometer wire are well connected.</li> <li>2. Replace the control PCB PM-149-A0.</li> </ol>
The meter does not display.	Check if the auxiliary power transformer on control PCB PM-149-A0 works normally. If it does, replace the control PCB PM-149-A0. Otherwise, replace the auxiliary power transformer. If the problem remains, replace the meter.
The electrode holder becomes very hot.	The rated current of the electrode holder is lower than its actual working current. Replace it with a higher rated current.
Excessive spatter in MMA welding.	The output polarity connection is incorrect. Exchange the polarity.

## 7.4 Appendix

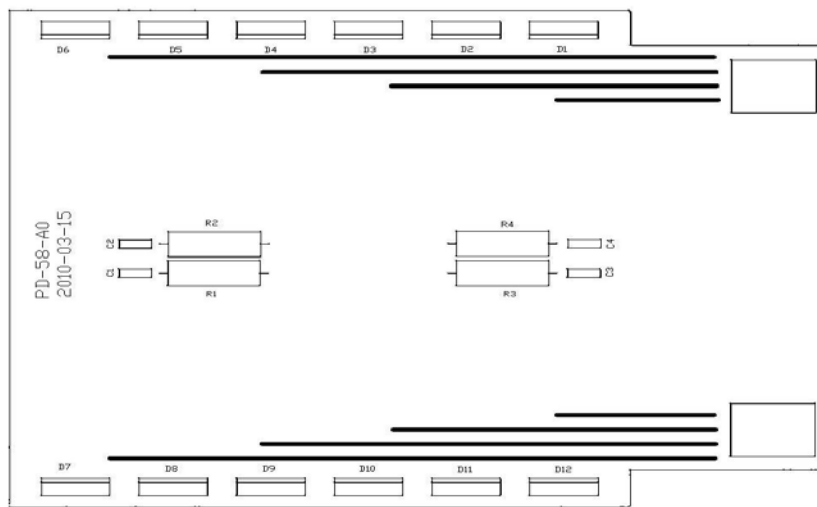
### 1) Bare PCB diagrams



**PS-18-A0 (power conversion board of ARC315)**



**PN-40-A0 (inverter PCB of ARC315)**



**PD-58-A0 (rectifier PCB of ARC315)**

## 2) Test data for chip pins

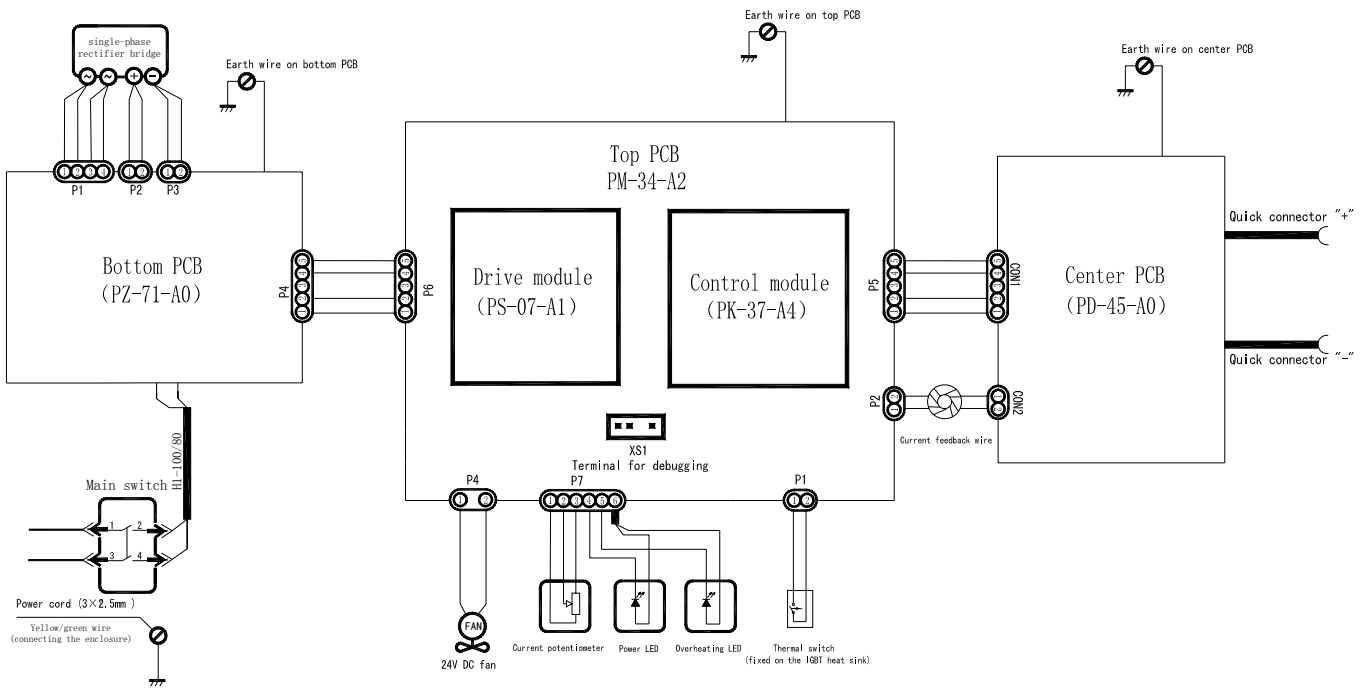
Refer to 6.4 2).

## 3) Spare parts list

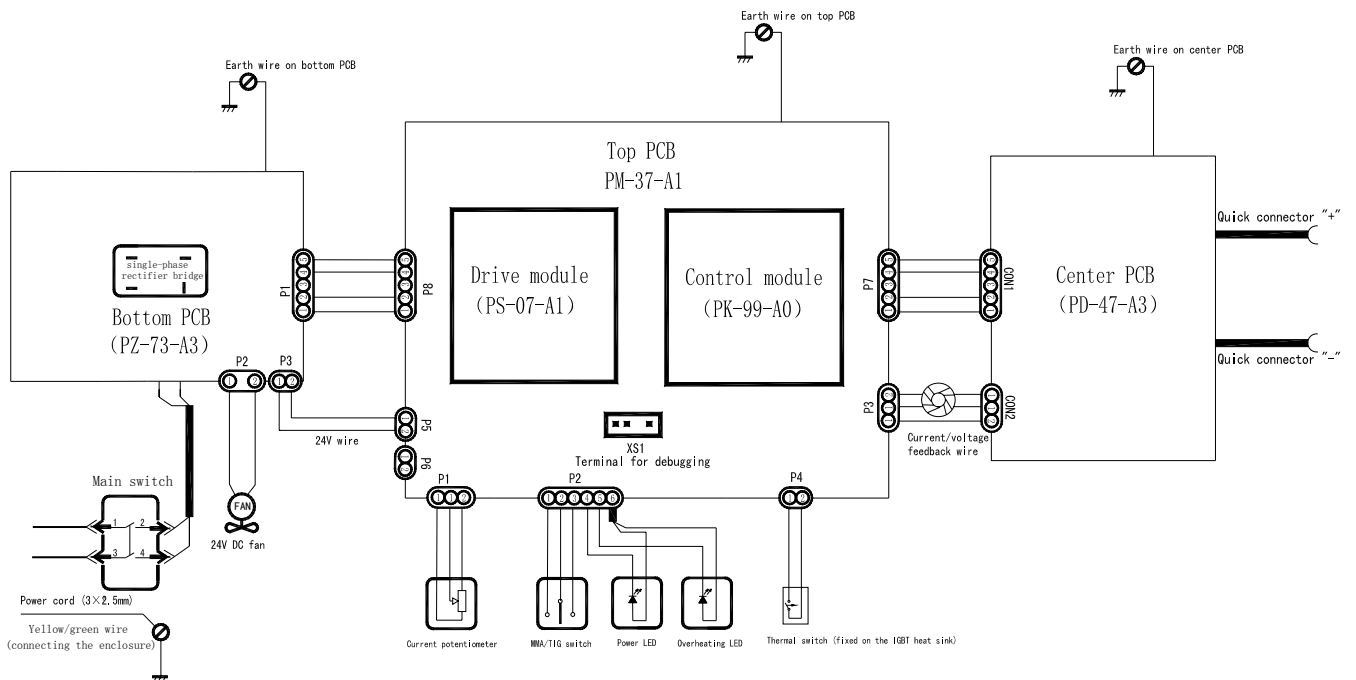
No.	Part number	Part name
1	D24015	IGBT-FGL60N100
2	RSD04025	Rectifier diode D92-02
3	D02387	Capacitor CBB21-B-800V-10uF-K
4	D19049	IC KA3846
5	D19026	IC TL084
6	D05109	NMOS transistor IRFZ24N
7	D05112	PMOS transistor IRF9Z24N
8	D03536	Auxiliary power transformer (Primary: 5V3-110; Secondary: 3V2/2V2-110)
9	D04029	Rectifier diode UF4004
10	D18300	Silicon bridge MDS50A/1400V
11	D19011	Zener diode KA7815
12	D15101	Carbon film potentiometer WH30P-B1K-20/3

## 8. Appendix

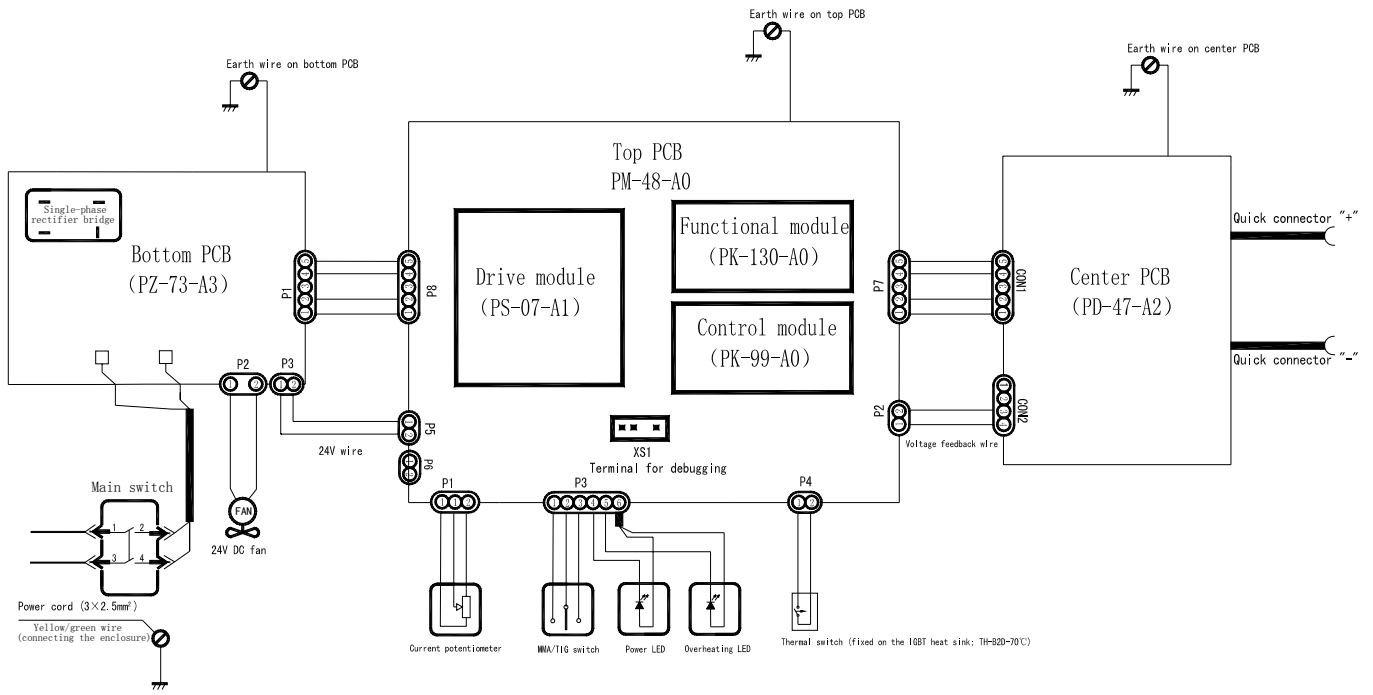
### 8.1 Wiring diagram of ARC100



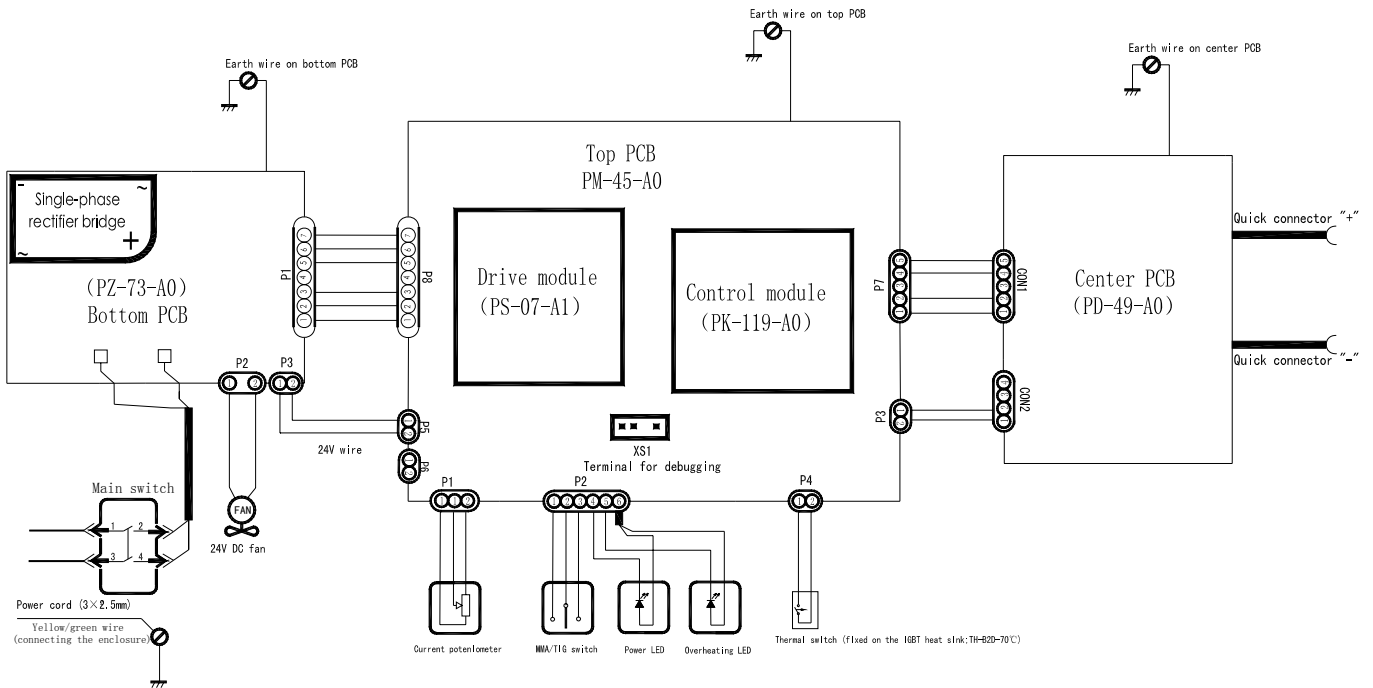
### 8.2 Wiring diagram of ARC120/ARC130



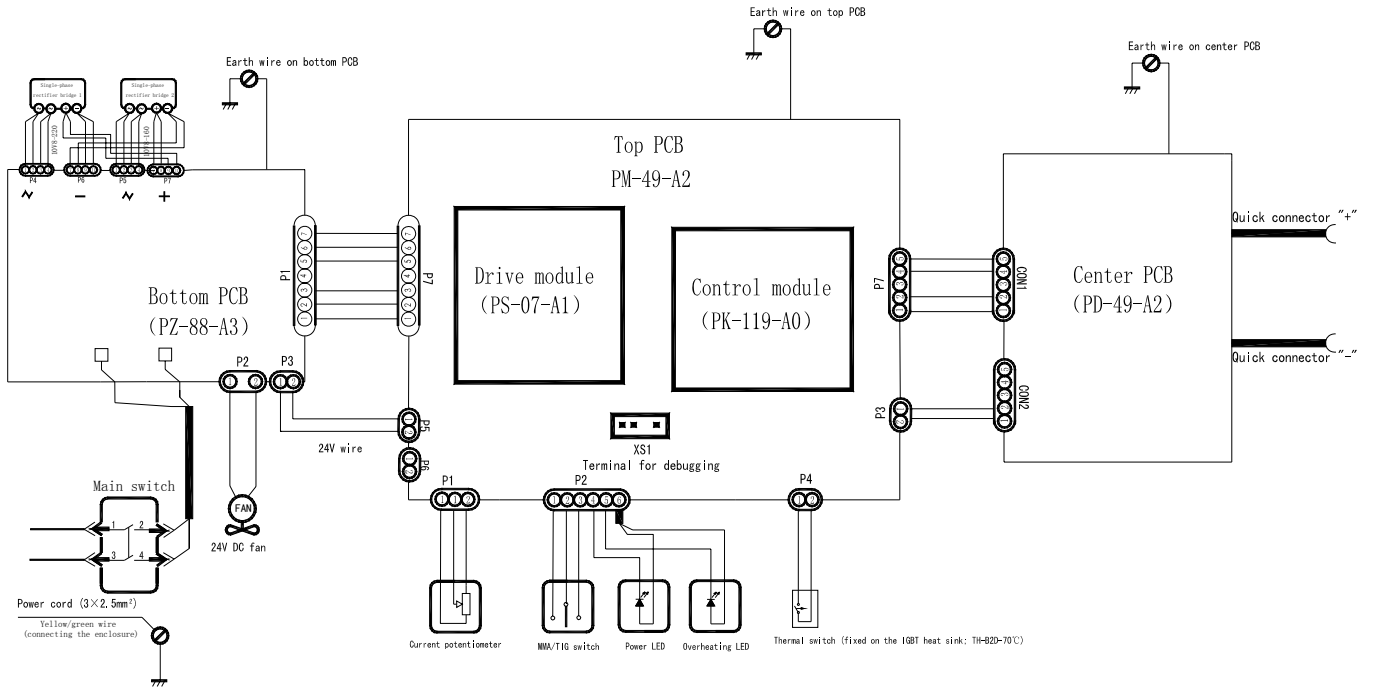
### 8.3 Wiring diagram of ARC140



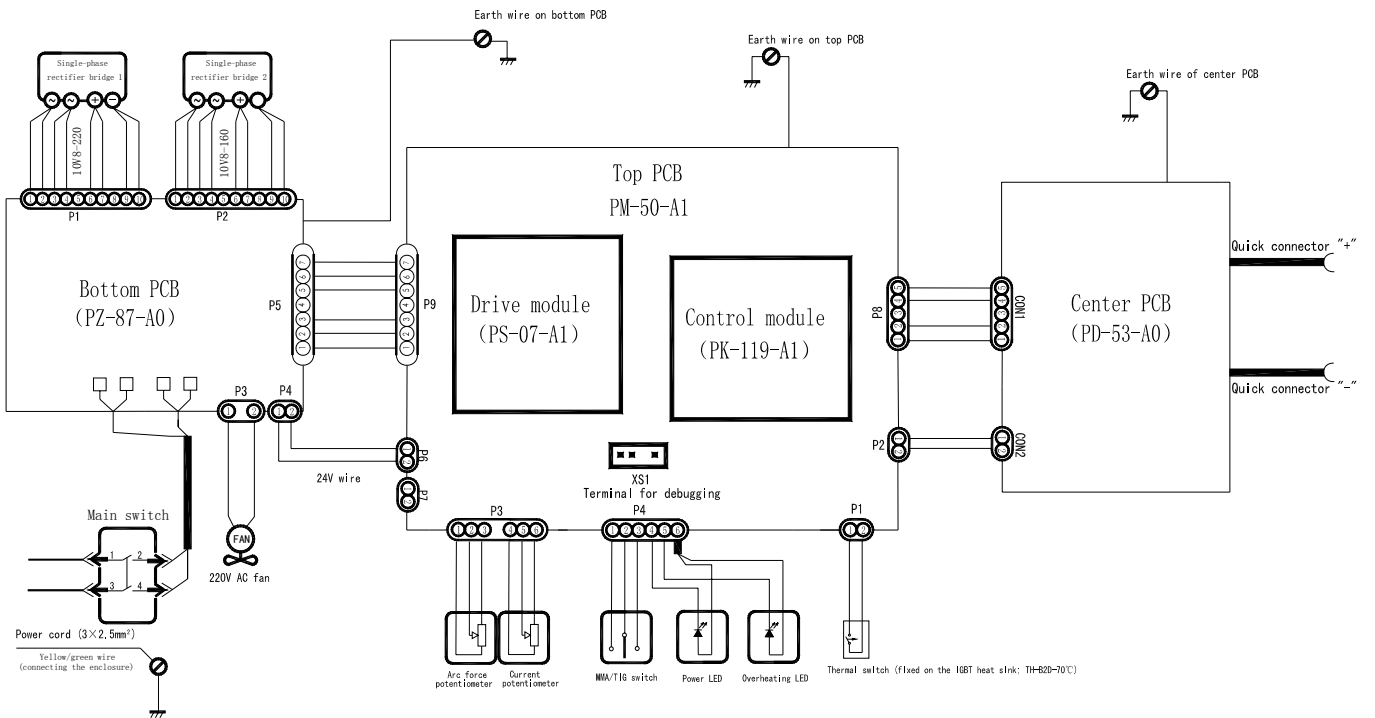
### 8.4 Wiring diagram of ARC160/ARC170



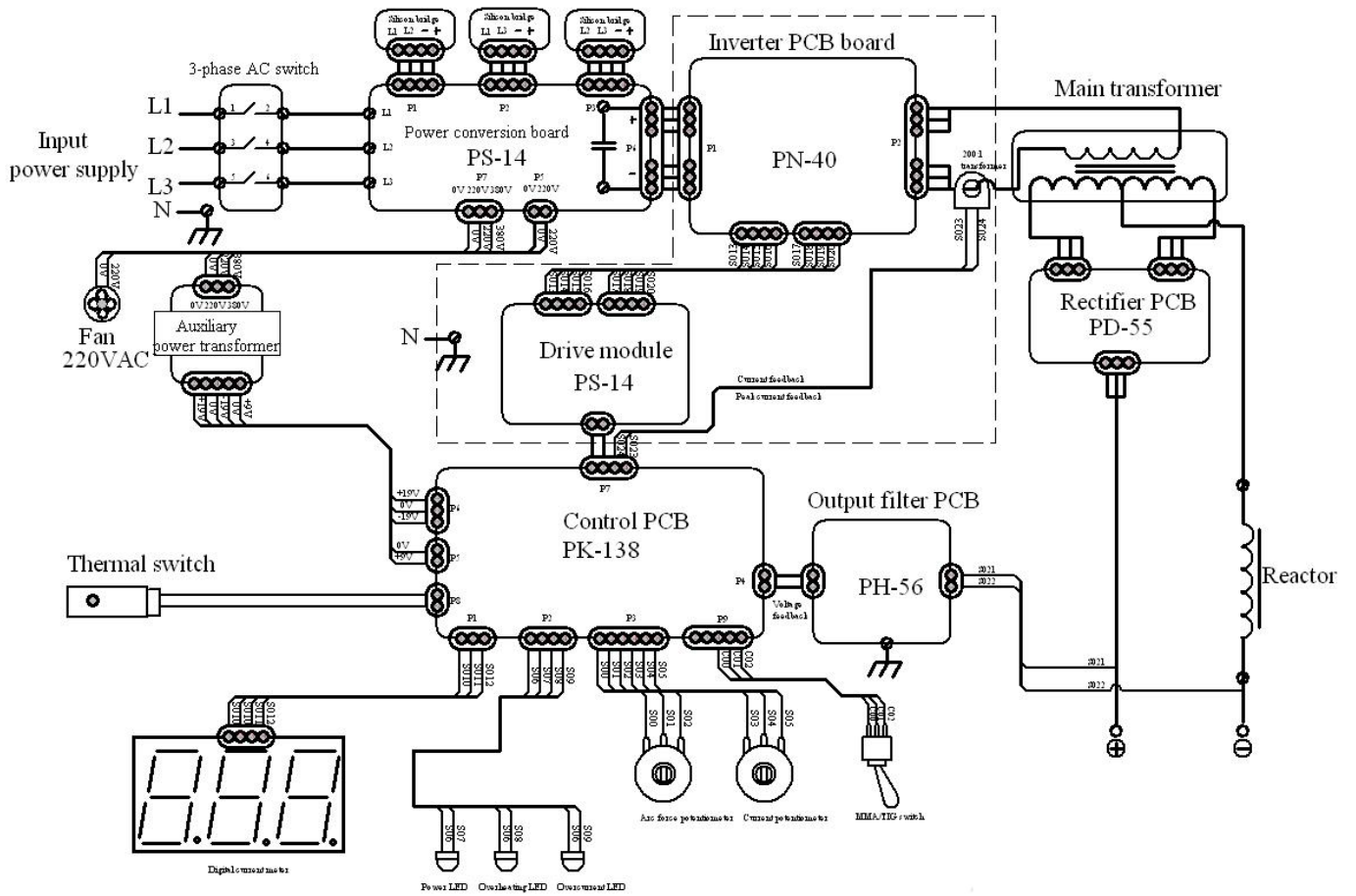
## 8.5 Wiring diagram of ARC180



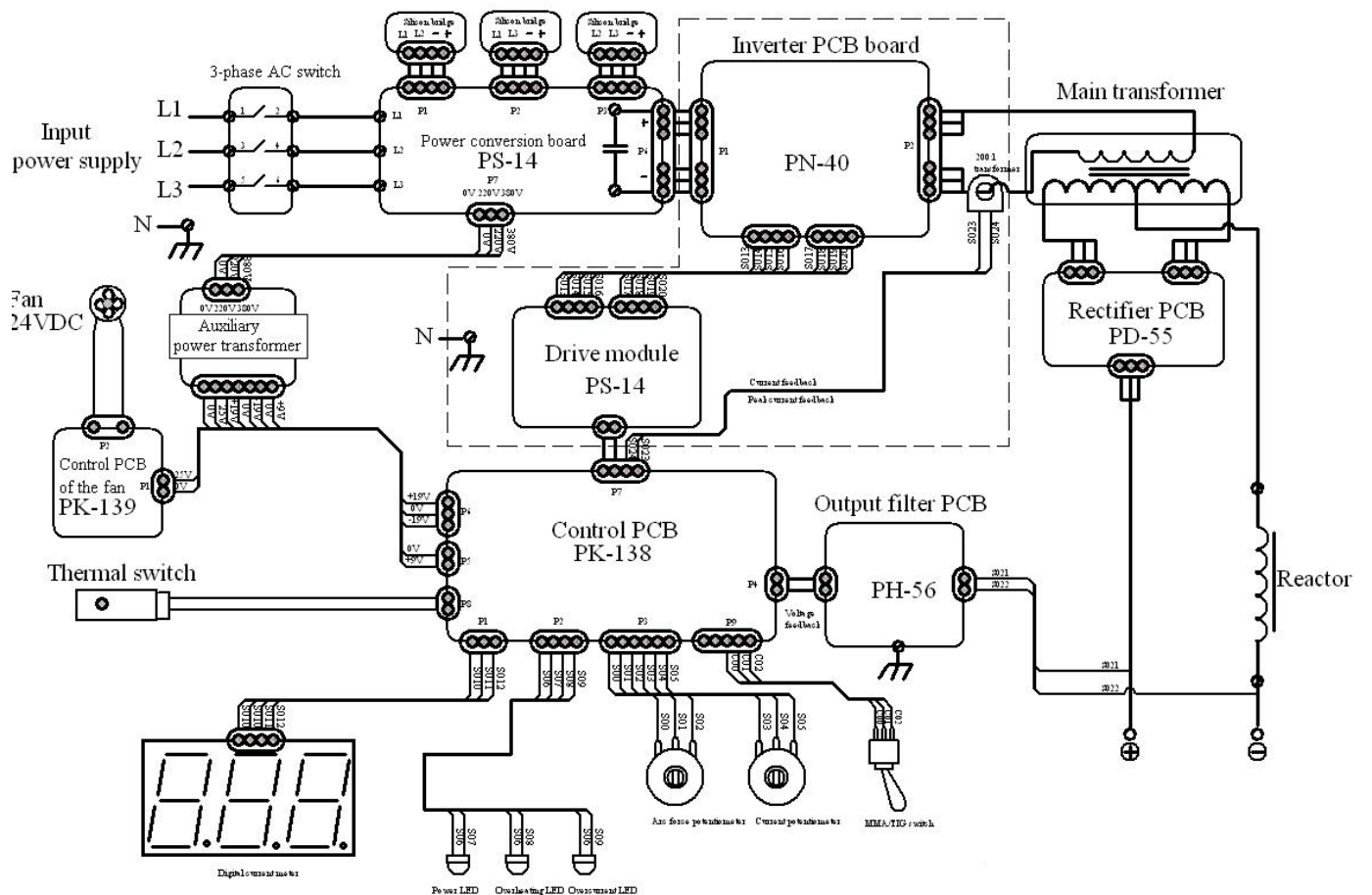
## 8.6 Wiring diagram of ARC200



## 8.7 Wiring diagram of ARC220



## 8.8 Wiring diagram of ARC250



## 8.9 Wiring diagram of ARC315

