

TIG400/TIG400P Maintenance Manual

1. Precautions

1.1 Please don't maintain the machine while it is powered on, or there might be risk of electricity shock.

1.2 Please make sure the well connection of all parts after maintenance, especially the cooling fan, or there might be danger of IGBT explosion.

1.3 Please apply heat dissipation silicon ester on IGBT.

1.4 There are dangerous voltage zones on both high and low voltage PCB. Please pay attention to it while testing with machine being powered on.

1.5 Please remove all high frequency discharge parts while test the machine with oscilloscope and multimeter, or it might damage the testing appliances.

2. Functions

This TIG400 machine is a digital controlled DC MMA/TIG welding machine. It is of mature functions, excellent performances and advanced technologies. This machine is equipped with MMA\DC TIG\TIG PULSE functions, which can satisfy welding needs for carbon steel, stainless steel, copper and its alloys.

3. Functional block diagram

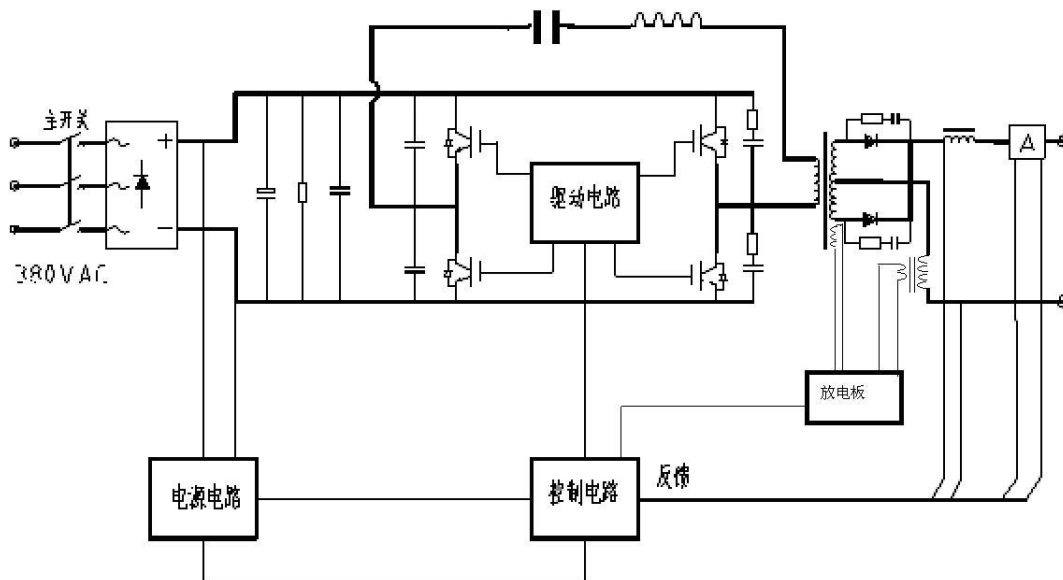
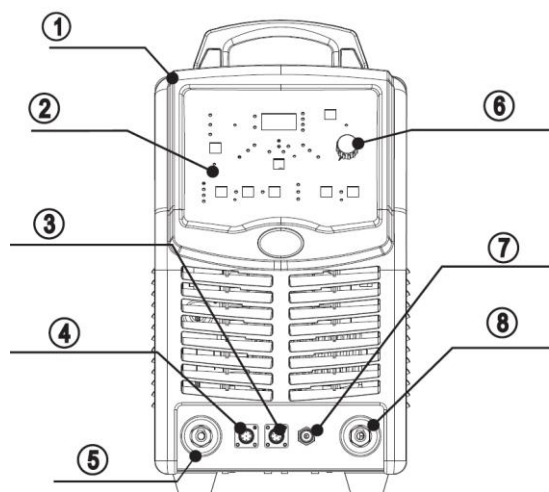


Fig 3.1 Functional block diagram

The three phase AC current ($\sim 380V / 50Hz$) provided by the 3 phase AC mains will be rectified and filtered by industrial frequency and be provided to IGBT inverter and inverted into 20KHz AC current. It will then isolated and stepped-down by medium frequency transformer and later be rectified by fast recovery diode for DC current which is needed.

4. Panel description

TIG400 (W322) front panel



The only difference between TIG400(W398) and TIG400P (W322) is TIG400(W398) has no pulse TIG function; Therefore, this manual will only offer detailed appearance description on TIG400P (W322).

No.	Part name	Function
1	Protective bar for front panel	To protect and fix the front panel and cover.
2	Sticker on front panel	To indicate the functions on the operation panel with the silkscreen.
3	Socket for the torch switch	To connect the torch switch.
4	Aviation socket	To connect the remote control.
5	“+” output terminal	To connect the earth clamp.
6	Rotary knob	To adjust parameters
7	Gas outlet	To connect the gas connector of the TIG torch.
8	“-” output terminal	To connect the TIG torch.

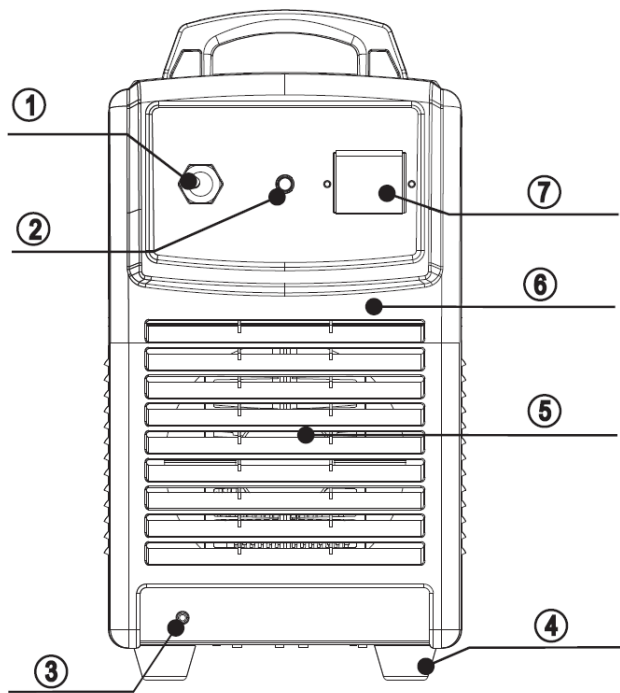
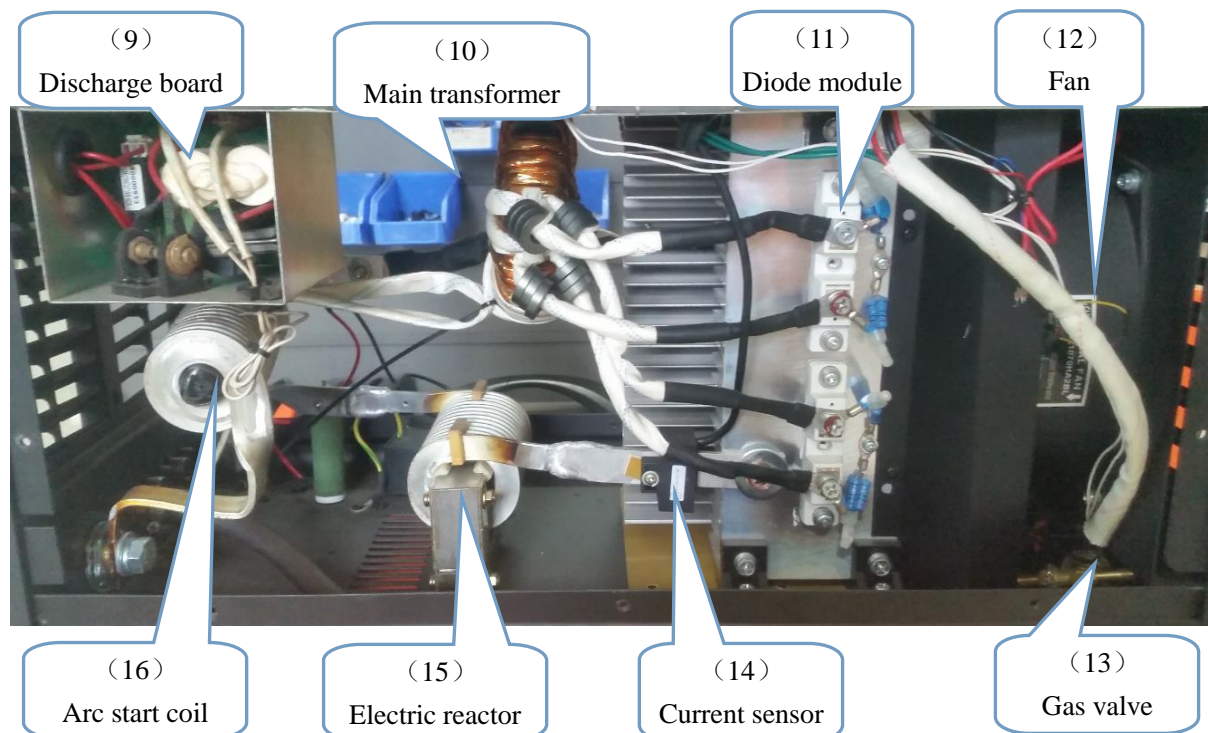
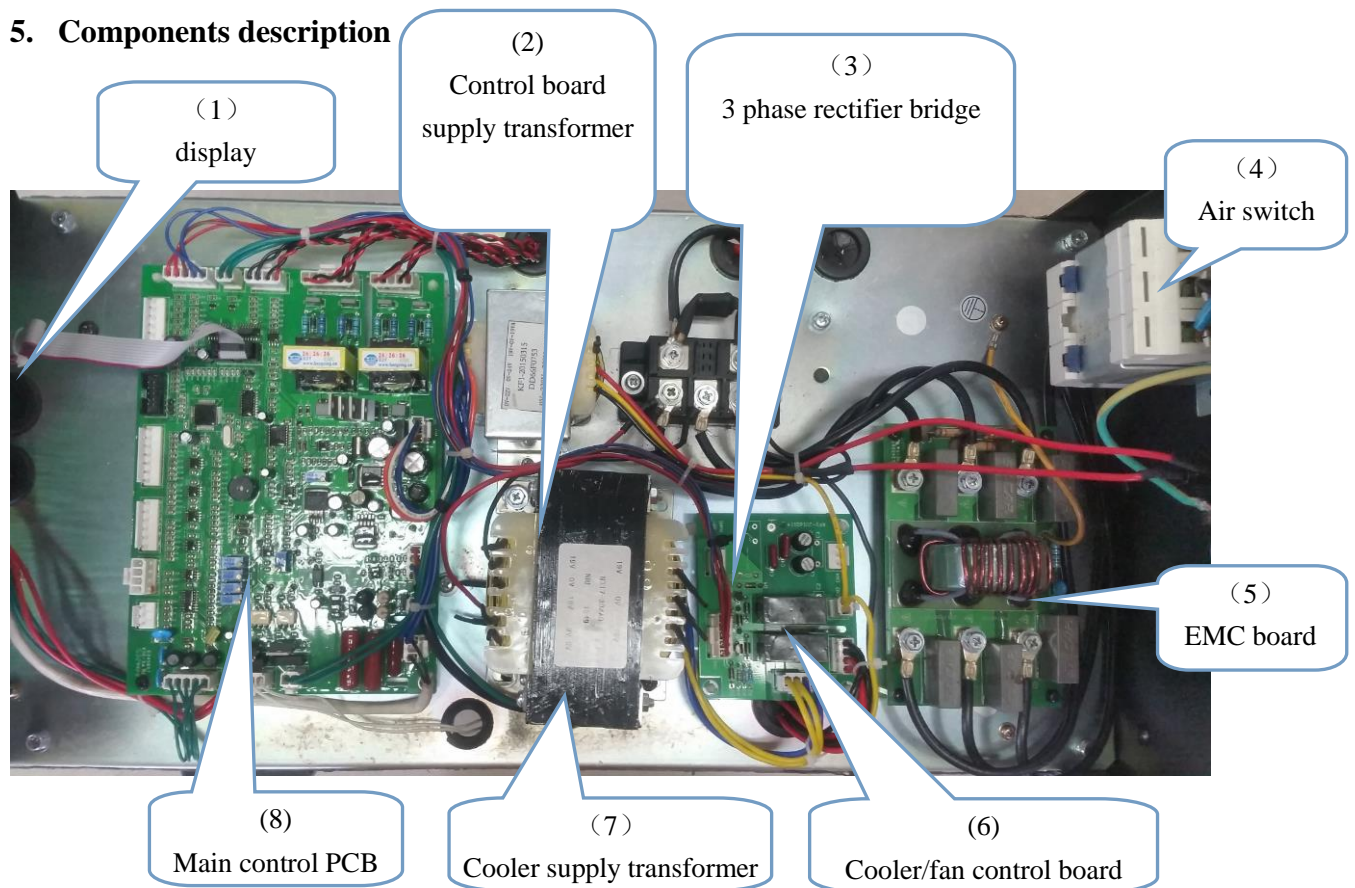
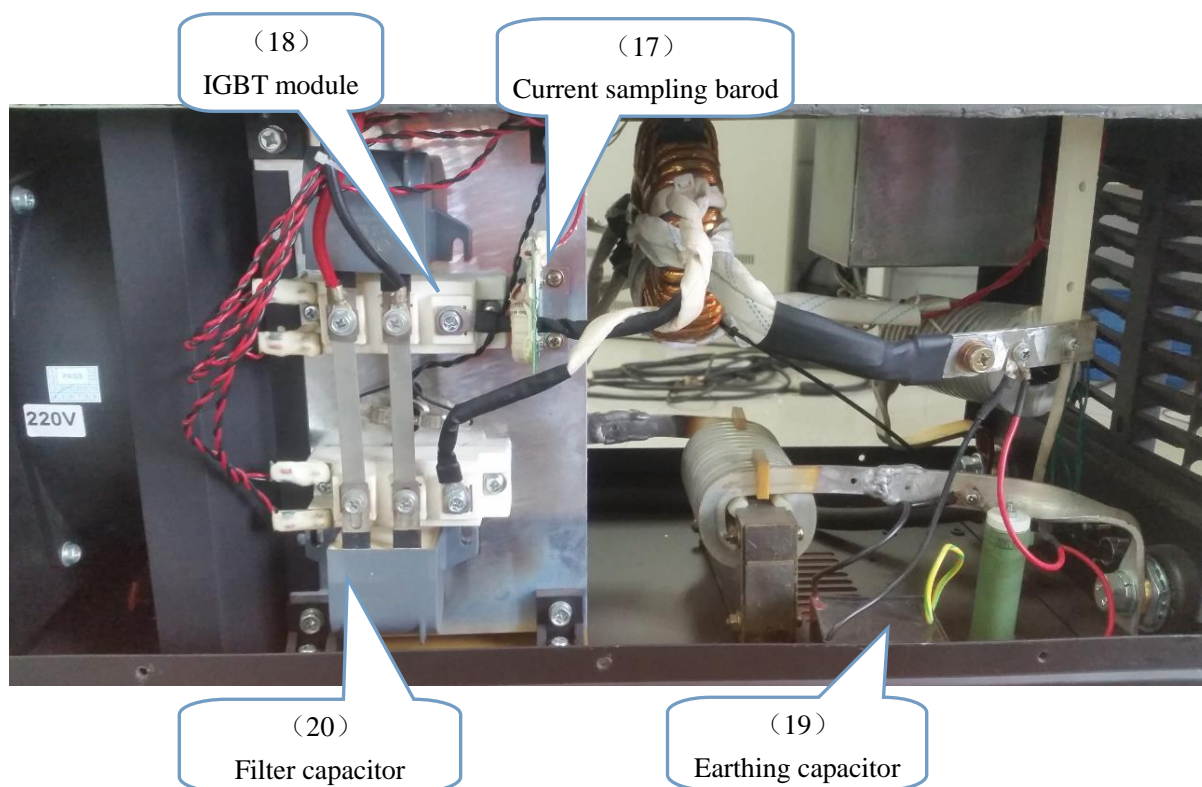


Figure: Back panel

No.	Part name	Function
1	Cable	For power supply input.
2	Fuse holder	The fuse holder for control circuit (for installing a 5A fuse).
3	Gas inlet	To input the shield gas.
4	Rubber foot	To support the machine.
5	Shutter on the back panel	As the entrance to air duct, to protect the cooling fan.
6	Back panel plastic enclosure	
7	Power switch	To control the ON/OFF of the input power of the machine.

5. Components description



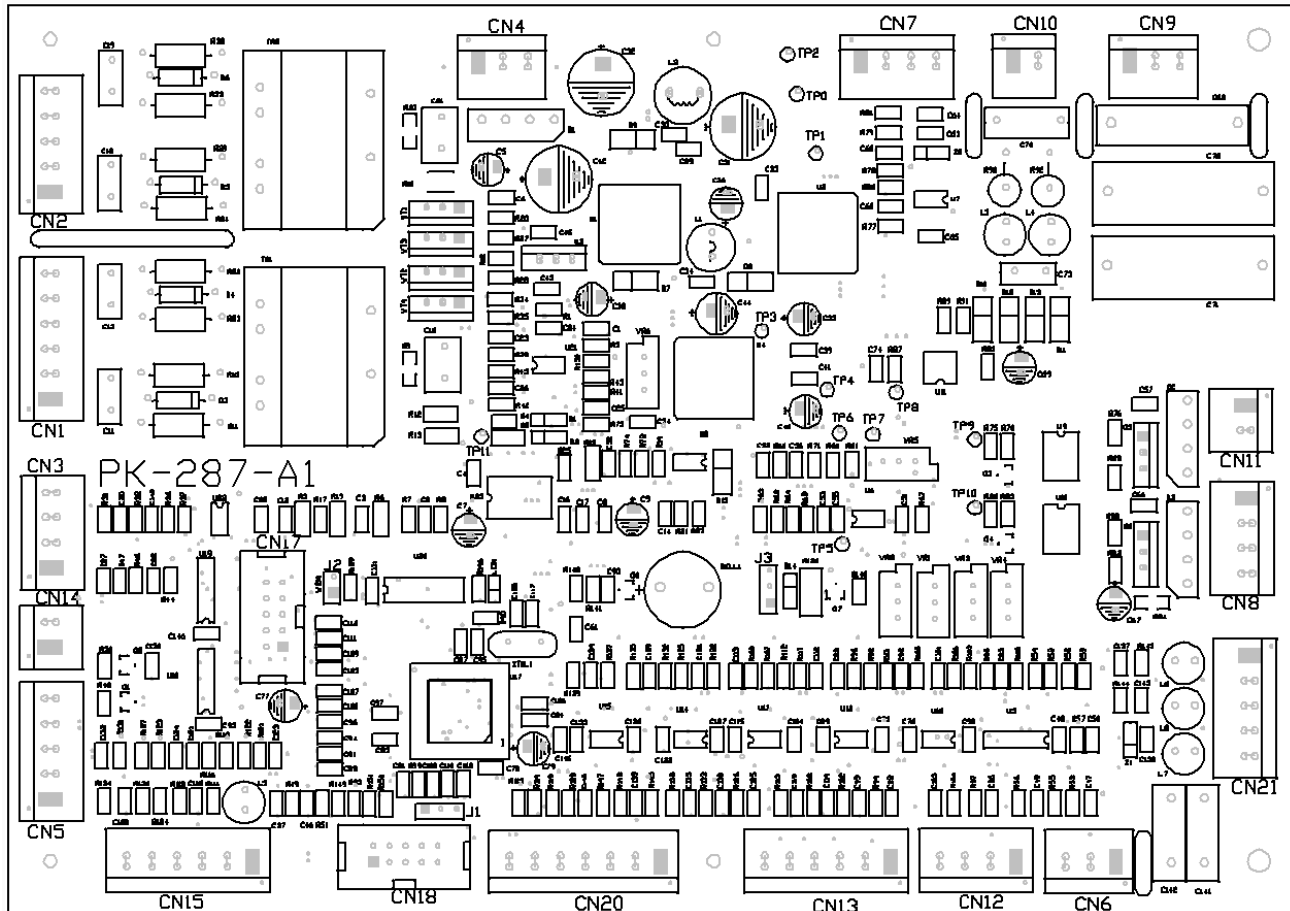


	SAP code	material	Description
(1)	10055492	Display	W322B003-22-A0(PX-25) lead-free
(2)	10055171	Control board supply transformer	Industrial frequency transformer: W322-24/A0 380/415V lead-free
(3)	10006635	3-phase rectifier bridge	MDS60A/1200V lead-free
(4)	10021936	Air switch	DZ47-3P-63A(red) lead-free
(5)	10027249	EMC board	I212Z245-23(PH-166-A1)
(6)	10056384	Cooler control board	W322-23-A1(PH-221) lead-free
(7)	10055900	Cooler supply transformer	N317-30/A0 220/380/415V lead-free
(8)	10055114	Main control board	W322B003-21-A1(PK-287)-S1 lead-free
(9)	10000933	Discharge board	W302-22(PH-144-A5)
(10)	10045592	Main transformer	Z312-29/A0
(11)	10006645	Fast recovery diode module	MMF200ZB040DK1 lead-free
(12)	10027895	Fan	G21070HA2(220Vblack)
(13)	10007285	Solenoid valve	VZ-2.2 DC24V (YD707/01)L=650
(14)	10006800	Current sensor	TKC400BR lead-free
(15)	10055605	Electric reactor	W398-31/A0
(16)	10047112	Arc start coil	W398-54/A1
(17)	10007267	IGBT module	GD50HFU120C1S
(18)	10055702	Current sampling board	J58-45(PH-137)4V2-340 lead-free

(19)	10043085	Earthing capacitor	OT4/6-150(474/1KV*2+183/3KV*2) lead-free
(20)	10005910	Filter capacitor	MKP-LS-20uF-800V(Square)

6.PCBA Pin description

main control board : (PK-287)



a) **Functions:** can process all signals through SCM for logical analysis and send out the according control signals. :

PID 、 PWM 、 IGBT drive etc.

b) Pin description

CN1 : IGBT's drive signal output, $\pm 15V$; Pin 1/6 is connected with Grid ; Pin 2/5 is connected with Source;

CN2 : IGBT drive signal output, $\pm 15V$; Pin 1/5 is connected with Grid; Pin 2/4 is connected with Source.

CN3 : over heat and over current protection detection; Pin1 and Pin2 are connected with thermoswitch;

Pin3 and Pin4 connected with current sampling board.

CN4 : connected with AC 19V-0-19V ; industrial frequency transformer provide power supply to PCB.

CN5 : connected with front panel indicator : Pin 1 and Pin2 is 5V; Pin 3 is connected with power supply indicator; Pin 4 is connected with over-heat indicator; Pin 5 is connected with over-current indicator.

CN6 : connected with display; Pin 1 is 5V; Pin2 is GND; Pin3 is display signal,0-2V.

CN7 : current sampling: Pin1 is DC+15V; Pin 2 is DC-15V; Pin 3 is current amps signal, 0-4V; Pin 4 is GND.

CN8 : gas valve, discharge control; DC24V output; Pin1 and Pin2 connected with gas valve. Pin3 and Pin4 connected with discharge board.

CN9 : connected with torch switch.

CN10 : industrial frequency transformer to provide power supply to PCB. AC 22V

CN11 : industrial frequency transformer to provide power supply to PCB. AC 26V

CN12 : connected with front panel potentiometer; Pin 1 is 5V; Pin 2 is GND; Pin 3 is pulse frequency signal; Pin 4 is pulse duty factor signal (reserved)

CN13 : connected with front panel potentiometer; Pin 1 is 5V; Pin2 is GND; Pin3 is crater current; Pin4 is post flow time; Pin5 down-slope time; Pin6 is background current. (digital front panel machines are reserved)

CN14 : connected with water flow detection switch.

CN15 : rocker switch connector; Pin 1 is GND; Pin2 and Pin3 are MMA/TIG/PULSE choices; Pin4 and Pin5 are 2T/4T/Repeat choices; Pin6 is gas check/welding choices. (digital front panel machines are reserved)

CN17: connected with front panel communication connector; Pin 1 is 5V; Pin2 is GND.

CN18: ISP port

CN20: connected with front panel potentiometer; Pin1 is +5V; Pin2 is GND; Pin 3 is initial current; Pin4 is up-slope time; Pin5 is pre-flow time; Pin6 is peak current; Pin7 is blank. ((digital front panel machines are reserved)

CN21: remote control connector; Pin 1 and Pin2 are remote control detection; short circuit means is remote control connected; Pin 3 and Pin 4 and Pin5 are connected with remote control potentiometer.

a) Potentiometers on PCB

VR1 to adjust display's min preset current (when machine is under no load, adjust the front panel welding current potentiometer to the min value).

VR2 to adjust display's max preset current (when machine is under no load, adjust the front panel welding current potentiometer to the max value).

VR3 to adjust display's min real current(when machine is under loading, adjust the front panel welding current potentiometer to the min value, then trim VR3 to make display shows same value with ammeter)

VR4 to adjust display's max real current(when machine is under loading, adjust the front panel welding current potentiometer to the max value, then trim VR4 to make display shows same value with ammeter)

VR5 to adjust min real current (when machine is under loading, adjust the front panel welding current potentiometer to the min value, then trim VR5 to make ammeter show min output current)

VR6 to adjust max real current (when machine is under loading, adjust the front panel welding current potentiometer to the max value, then trim VR5 to make ammeter show max output current)

Remark: actual output current is the real time output current when machine is working.

Displayed preset current is the preset current on front panel display when machine is under no load.

Displayed actual current is real time output current display when machine is working; the display actual current is the same with actual output current.

The related debugging steps please refer to debugging introduction.

b) Faults on this PCB could possible cause no drive signal, no OCV, over-heat protection; over-current protection, no HF, no reaction when press torch switch, abnormal welding logic.

2) Display board: W322B003-22-A0(PX-25)

Functions: Show machine status, setting on functions and parameters.

Faults on this PCB could possible cause no display, no reaction when press the keys; faulty display

3) WSM400 discharge board: W302-22(PH-144-A5)

Functions: HF discharge.

Faults on this PCB could possible cause no HF, difficult arc start.

7. Failures and analysis.

1. protection (warning) solutions

Cate gorie s	Warning	Machine reaction	Analysis	Solutions
Over- curre nt	Over current indicator is on and display shows “E-0”	Permane nt shut down on main circuit	1. Accidental interferences cause faulty protection. 2. load current is too big; 3. diode is failed. 4. IGBT is failed.	1 turn off the machine and restart it. 2.remove the main transformer secondary wire and check if the diode is failed or not. 3.Check if IGBT is failed or not.
Over -heat	Over heat indicator is on and display shows “E-3”	Temporar y shut down on main circuit	1 long time working invoke over-heat protection. 2.fan is not working. 3.thermoswitch might have failed.	1. power on the machine and wait for some time and see if the machine will resume to work later. 2.check if fan is working or not. 3. use a multimeter to check thermoswitch, which should be closed. If it’s open, it means the thermoswitch is failed.
Abno rmal water-coo ling	No indicator on front panel is on and display shows “E-5”	Temporar y shut down on main circuit	1.lack of water; or abnormal water cooling configuration. 2.blocked water circuit or crushed water pipe.	1.add appropriate amount of water and check the water cooling configuration. 2. check if the water pipe is under good condition or not.

2.simple failure troubleshooting

fault		analysis	solutions
Fan doesn’t work or work at abnormal speed.		1. 3-phase power cable is not well connected. 2. phase loss 3.mains voltage is too low	1.connect well the 3 phase power cable. 2.check and solve the problem of mains phase loss. 3.resume to work when mains voltage is back to normal.
MMA	Difficult arc start	Arc start current is too small	Add arc start current to an appropriate level.

	Explosive arc start or too big molten pool during arc start	Arc start current is too big	Decrease arc start current to an appropriate leve.
	Abnormal arc start	Mains phase loose or power cable is not well connected.	Connect well the power cable or solve the mains phase loss problem.
	Easy sticking	Arc force current is too small	Add the arc force current to an appropriate level .
	No OCV while under MMA; abnormal voltage indicator is on	1. mains under voltage 2.mains over voltage	1. resume to work when mains voltage is back to normal. 2. cut off the machine power supply and reconnect with mains when voltage is back to normal.
	Electrode is hard to melt.	Wrong torch polarity connection	Exchange the quick connector. MMA: “+” is connected to the torch and “-“ is connected to the workpiece.
TIG	Easily burnt tungsten	Wrong torch polarity connection	Exchange the quick connector. TIG: “+” is connected to the workpiece and “-“ is connected to the torch.
	No discharge arc start when press torch switch during HF arc start	Failure on welding circuit	Check the welding circuit and reconnect it well.
		Touch switch is not well connected	Connect well the torch switch
		The discharge board nozzles gap is too big.	Adjust the discharge board nozzles gap to 0.8mm(approximate)
		Torch switch and machine plug cable are broken.	Replace the torch switch
	Blackened welding spot	Welding spot is not well protected and is oxidized.	1 make sure the gas cylinder valve is open and there is enough air pressure. 2. Check if argon gas flow is normal or not. 3. check gas circuit tightness or gas purity. 4. check if there is strong air flow in the working environment.
	Difficult arc start; easy arc interruption	Tungsten electrode is oxidized. Gas circuit is not under good condition or gas flow is too small. Torch and workpiece distance is too big.	1.remove the tungsten electrode oxidized layer and replace a better quality tungsten electrode. 2. set a longer post flow time so that to avoid tungsten oxidation. 3. adjust the discharge board nozzles ap to 0.8mm(approximate) 4. check gas circuit or increase gas flow. 5. increase welding current or background

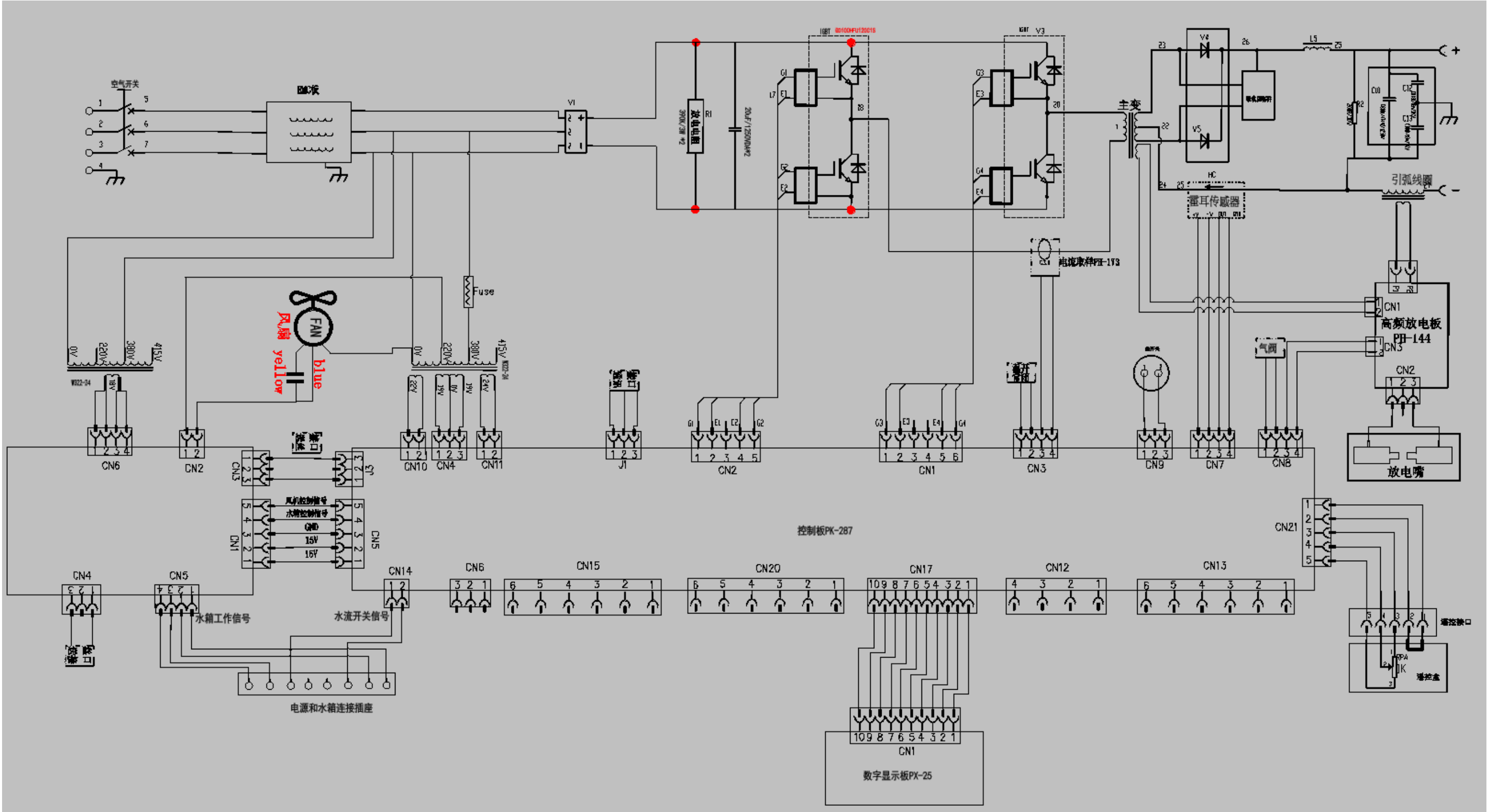
			current to an approximate level.
	Abnormal 2T/repeat/4T logic	Fault on 2T/repeat/4Tsetting	1. make sure the torch switch is under good condition. 2. Reset the 2T/repeat/4T
	Unstable current during welding	1.mains voltage varies a lot or poor connection with the mains. 2. interferences from other appliances.	1.check if the mains is under normal condition or not and connect well the power cable. 2. connect different power cable if there is appliances with big interferences.

3.common failure troubleshooting

Fault	Analysis	Solutions
Fan works at slow speed or is not working.	1.mains is not under good condition. 2.380V power cable is not well connected or phase 3.fuse is burnt. 4. fan is failed.	1.resume to work when mains is back to normal. 2.reconnect well the power cable. 3. replace the fuse. 4.if the above solutions are not working, replace the fan.
Air switch is always open	1. short circuit on 380V power cable. 2.air switch is failed. 3. machine short circuit inside.	1. check if there is a power cable short circuit or not. 2. check if air switch is failed or not;if yes, replace it with a new one. 3.check if IGBT and rectifier module is failed or not.
Abnormal discharge	1. torch switch is failed. 2. poor connection of torch switch and machine. 3. discharge board is failed or discharge nozzles distance is too small. 4. control board discharge part is failed. 5.industrial frequency transformer is failed.	1.replace the torch switch 2. make sure good connection between torch switch and machine. 3. Replace discharge board or adjust the distance between discharge nozzles to 0.8 ~ 1mm 4.check the voltage between discharge board CN8's Pin3 and Pin4. If there is no voltage change when press torch switch(change from OV to DC24V), it means discharge board is failed. Please replace it with a new one. 5. check if there is 26V input for control board's CN11; If no, replace the power supply transformer.
No argon from the torch	1. no argon in the cylinder; or gas valve is not open.	1.open the gas valve or replace the argon gas cylinder.

	2. gas hose is failed. 3. control board gas valve control part is failed. 4. solenoid valve is failed. 5. Industrial frequency transformer is failed.	2.replace the gas hose. 3.check the voltage between control board CN8 Pin 1 and Pin 2. If there is no voltage change(from 0V to DC24V) when press torch switch or switch the gas detection/welding, if means control board gas valve part is failed. Replace the control board. 4. replace the solenoid valve. 5. check if there is AC26V input for control board CN11. If not replace the power supply transformer.
No reaction when power on the machine	1.abnormal power input 2. power drive board is failed. 3. control board is failed.	1. Check power supply input. 2. Check the voltages for the several testing points on PCB. If there is abnormal voltage, please replace it with a new one. 3. If the above solutions still can not solve the problem, replace the control board.
Machine explosion	1. IGBT is failed. 2. IGBT drive board is failed. 3. control board is failed.	1. Check if IGBT is failed or not. 2. Check IGBT drive voltage is +/-15V or not with a oscilloscope. If not, replace the IGBT drive board. 3. If the above solutions still can not solve the problem, replace the control board.
No current display or unadjustable current output	1. poor connection with Hall sensor 2. Hall sensor is failed.	1 Make sure the Hall sensor wire is well connected. 2 Replace the Hall sensor. Hall is 400A/4V.

8. SCHEMATIC DIAGRAM
1.Wiring diagram



2.recommended welding processing specifications

Electrode diameters (mm)	Recommended welding current (A)	Recommended welding voltage (V)
1.0	20~60	20.8~22.4
1.6	44~84	21.76~23.36
2.0	60~100	22.4~24.0
2.5	80~120	23.2~24.8
3.2	108~148	24.32~24.92
4.0	140~180	24.6~27.2
5.0	180~220	27.2~28.8
6.0	220~260	28.8~30.4

Flux coated electrode MMA processing specification

Tungsten diameter (mm)	Stainless steel plate thickness (mm)	Max current (A)	Max argon flow (l/min)
1~2	1~3	50	5
		50~80	6
2~4	3~6	80~120	7
		121~160	8
		161~200	9
		201~300	10

Stainless steel plate-MMA/TIG processing specifications

3. operation description

when press torch switch it's on; when release torch switch it's off. Please refer to Fig3-1.

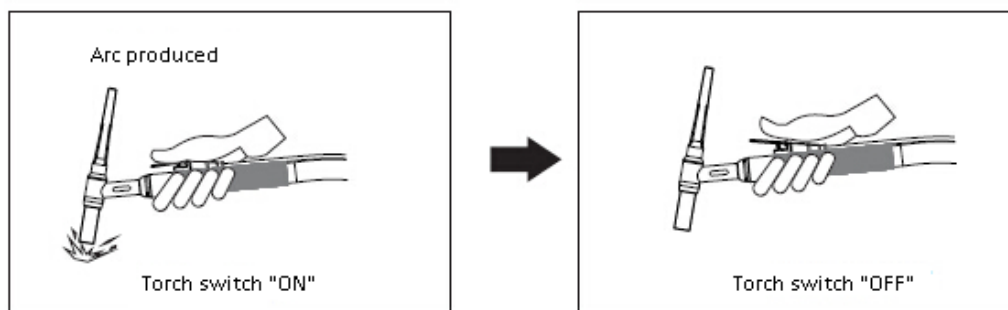


Fig 3-1 TIG torch switch on/off operation

1) 2T operation as shown in Fig 3-2

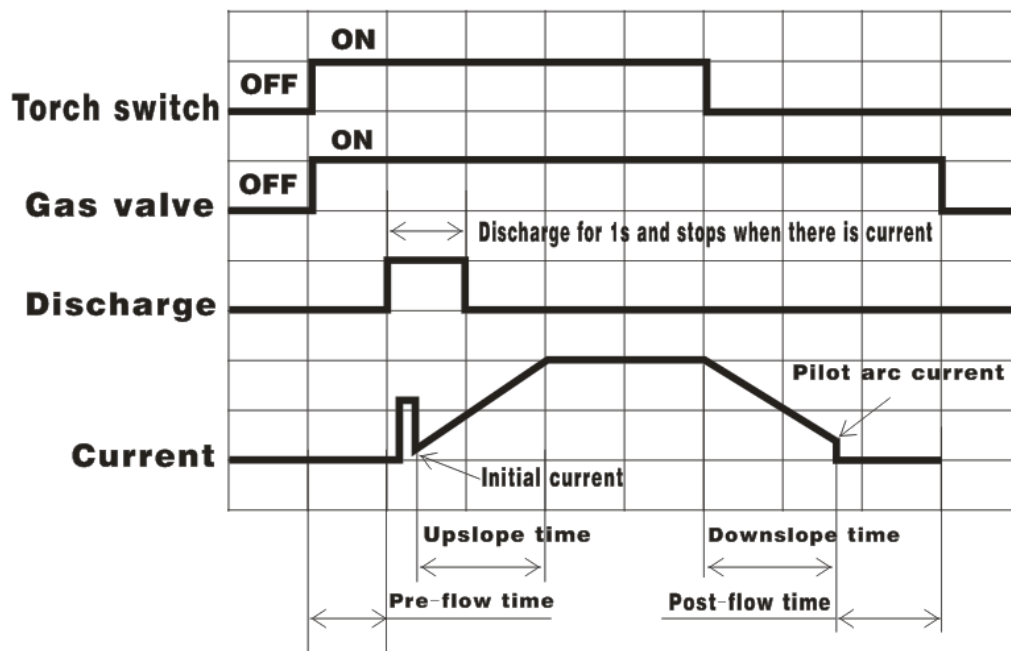


Fig 3-2 2T operation

If machine is under 2T mode, the gas valve will open when press torch switch ; after the preflow time is ended, it will goes to discharge arc start and goes upslope to welding current. When release troch switch, it will enter down slope till to the pilot arc current and cut off power supply. The gas valve will close when post flow time is ended and the whole welding processing is completed.

During the phase of down-slope, if operator presses torch switch, it will goes to upslope and then welding current phase. Wait for the next release of torch switch.

2) 4T operation as shown in Fig 3-3

If machine is under 4T, the gas valve will open when press torch switch. after the preflow time is ended, it will goes to discharge arc start. When arc is started successfully, it will output initial current. When release torch switch, it will goes up to welding current and locked there. When press torch trigger again, it will enter down slope and pilot arc current. When release torch switch for another time, it will cut the current output.if release torch switch at anytime during the down-slope phase, it will cut off current output immediately. The gas valve will close when current output is cut off and post flow time is ended and the whole welding processing is completed.

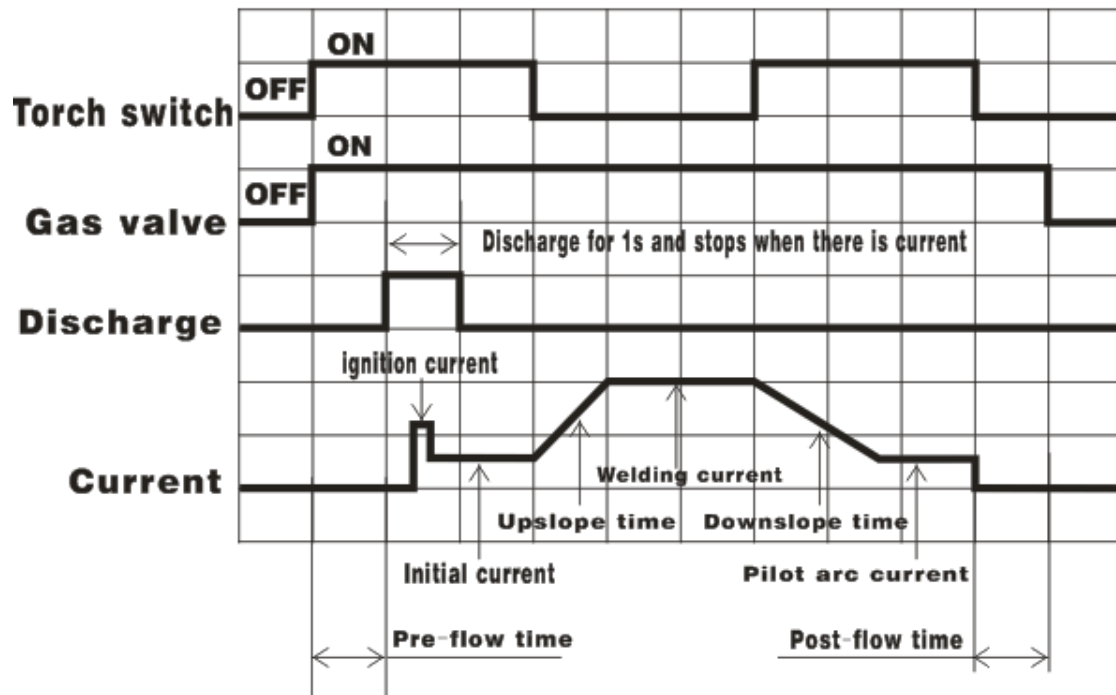


Fig 3-3 4T operation

3) repeat operation as shown in Fig 3-4

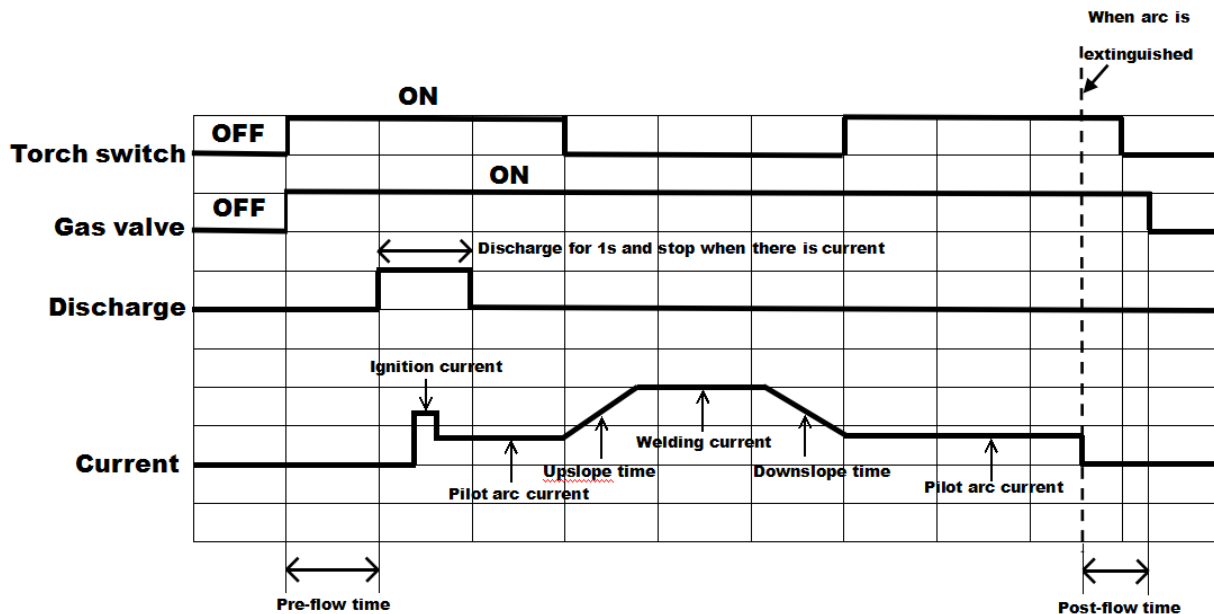


Fig 3-4 repeat operation

If machine is under repeat mode, the gas valve will open when press torch switch. after the preflow time is ended, it will goes to discharge arc start. When arc is started successfully, it will output pilot arc current; When release torch switch, it will goes upslope to welding current. When press torch trigger again, it will enter down slope and pilot arc current. When release torch switch for another time, it will goes up-slope to welding current. The so called repeat is that machine have repetitive changes between pilot arc current and welding current. If press torch switch within 1 second of releasing torch switch, and release switch again, it will stop arc and cut off current output.gas valve will close when post flow time is ended and the whole welding processing is completed.

4 Technical specifications

Item		mode	
		TIG400 (W398)	WSM-400 (W322)
Input	Input power supply	3 phase AC380V±15% 50/60Hz	
	Rated input capacity(KVA)	18.8	
	Power factor	0.9	
MMA	Rated OCV(V)	66	
	Rated max output(A/V)	400/36	
	Welding current (A)	10~400	
	Arc force current(A)	0~200	
	Arc start current(A)	0~200	
	Output characteristics	CC(constant current)	
TIG	Rated max output (A/V)	400/26	
	Welding current(A)	5~400	
	Pre flow time (S)	0.2~10	
	Initial current(A)	5~400	
	Pilot arc current(A)	5~400	
	Up slope time(S)	0~10	
	Background current(A)	—	5~400
	Peak current(A)	10~400	
	Down slope time(S)	0~10	
	Post flow time(S)	0~15	
	Pulse frequency range(HZ)	—	0.2~200
	Pulse duty factor (%)	—	10~90
ENVIRONMENT	Working temperature (°C)	-10~+40	
	Storage temperature	-25~+55	

	(°C	
	humidity (%)	≤90 no water condensation
STRUCTURE	IP class	IP21S
	Cooling type	Force air cooling
Rated duty circle		50%
Efficiency		85%
Insulation grade		F