Kalstein

High Frequency Electrosurgical Unit

Model YR02144

Service Manual

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Table of Contents

Part 1

General

This part includes the following seven sections:

- Performance Description
- Operating Power Supply
- Operational Environment
- Transportation
- Configuration and Weight
- Inspection of Accessories
- Application of Accessories

Performance Description

YR02144 high frequency surgical applications are applicable to normal surgical, gynecological, facial, orthopedic, urological, cerebral, dermatological and thoracic surgeries. It is available for such work modes as simple cut, mixed cut, double pole cut, point coagulation, soft coagulation, surface coagulation and double pole coagulation.

The detail performance description is shown as follows:

1. It belongs to Class I CF equipment.
2. Operating Mode: intermittent loaded continuous operating
3. The double pole mode is available for both cut and coagulation, of which, the double pole coagulation can be divided into typical coagulation and precise coagulation.
4. The single pole mode is available for both cut and coagulation, of which the single pole cutting can be divided into simple cut, mixed cut 1, mixed cut 2 and mixed cut 3, and the single coagulation can be divided into soft coagulation, point coagulation and surface coagulation.
5. Testing system for affixing area of the pole plate
6. Single pole coagulation is available for concurrent output.
7. The volume is available for automatic regulation (except for alarm).
8. It can be equipped with argon device.

Operating Power Supply

220-240Vac, 50Hz power supply properly grounded

Operational Environment

Temperature：5-40℃

Humidity：≤80%RH

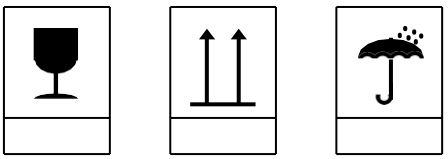
Range of Atmospheric Pressure： 700hPa～1060hPa

Clean Indoor environment which is free of any corrosion, flammable substance and has sound ventilation.

Transportation

Temperature：-40 ~ +55℃

Humidity：10~100%RH



Handle with care　Upwards　Waterproofing

Range of Atmospheric Pressure: 500hpa ~ 1060hpa

It is necessary to guard against any violent vibration, collision and rainsduring the progress of transportation of utilization.

Configuration and Weight

Packing Size (mm)：550*520*400

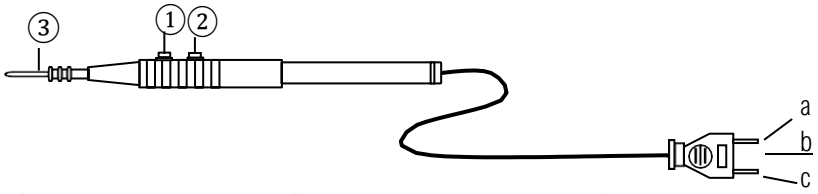
Gross Weight (kg): 23

Overall Dimension (mm): 516*410*160

Net Weight (kg): 20

Inspection of Accessories

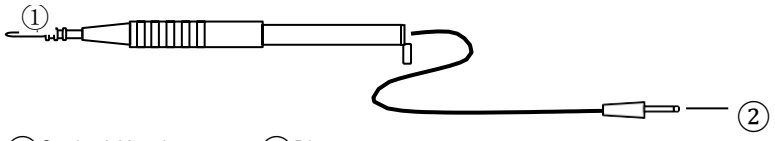
Manual Control Scalpel



①Cutting Button ②Coagulation Button ③Scalpel Heada
Cutting Terminal b Coagulation Terminal
c Common Terminal

- Manual control scalpel head ③ is switched into conduction with common terminal c.
- Start-up cutting button ① is switched into conduction with the cutting terminal of the manual control scalpel plug a as wellas the common terminal c.
- Start-up coagulation button ② is switched into conduction with the coagulation terminal b of the manual control scalpel plug a as well as the common terminal c.

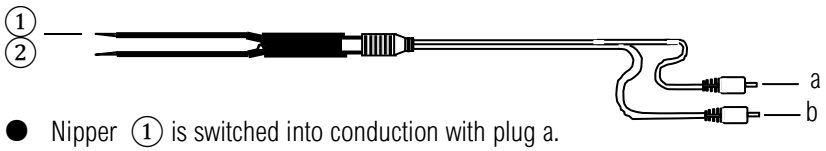
Foot Control Scalpel



①Scalpel Head ②Plug

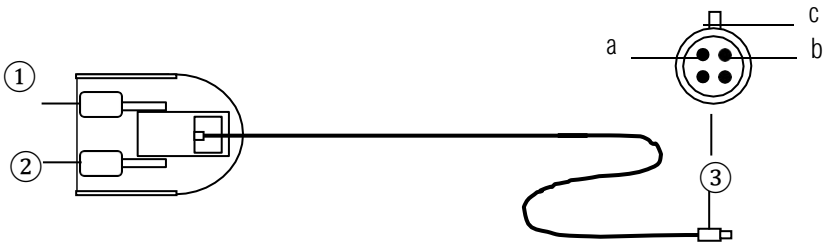
- Foot Scalpel Head①is switched into conduction with plug②.

Nipper and Connecting Line



- Nipper ① is switched into conduction with plug a.
- Nipper ② is switched into conduction with plug b.

Foot Switch



① Cutting Pedal ② Coagulation Pedal ③ Plug
a Cutting Terminal b Coagulation Terminal c Common Terminal

- Start-up cutting pedal ① and cutting terminal a of plug ③ areswitched into conduction with common terminal c.
- Start-up coagulation pedal ② and coagulation terminal b of plug ③ are switched into conduction with common terminal c.

Application of Accessories

Manual Control Scalpel

Directions for Use

1. Manual control scalpel is used in combination with principal highfrequency electric scalpel machine.
2. It should subject to the formaldehyde fumigation prior to operation.
3. It is a must to check whether the electrode is firmly fixed, any loose one should be replaced.
4. Insert the plug of the manual control scalpel head into the corresponding output plug jack.
5. Remove the protective cover of the scalpel head, and press the"CUT" or "COAG" to select either the electric cutting mode or electric coagulation mode.
6. It is proposed that the scalpel should be cleaned with medical tampon dipped with 70% alcohol for medical purpose during the operation.
7. Operational Environment
   Temperature: 5-40℃
   Relative Humidity: ≤80%

Note:

1. Please do not immerse the product in the detergent or sterilizing agent solution when performing the cleaning and disinfection.
2. As the product belongs to single pole electric scalpel head, one of itselectrodes should be connected with the body of the patient prior to operation.

Foot Control Scalpel

Directions for Use

1. Foot control scalpel is used in combination with principal highfrequency electric scalpel machine
2. It should subject to the formaldehyde fumigation prior to operation.
3. It is a must to check whether the electrode is firmly fixed, any looseone should be replaced
4. Insert the plug of the foot control scalpel head into the correspondingoutput plug jack
5. Remove the protective cover of the scalpel head, and press the "CUT" or "COAG" to select either the electric cutting mode or electric coagulation mode
6. It is proposed that the scalpel should be cleaned with medical tampondipped with 70% alcohol for medical purpose during the operation
7. Operational Environment
   Temperature：5-40℃ Relative
   Humidity：≤80%

Note:

1. Please do not immerse the product in the detergent or sterilizing agent solution when performing the cleaning and disinfection.
2. As the product belongs to single pole electric scalpel head, one of itselectrodes should be connected with the body of the patient prior to operation.

Soft Pole Plate Connecting Line

Directions for Use

1. This product can be used to connect the principal high frequencyelectric scalpel machine with soft pole plate.
2. It should subject to formaldehyde fumigation prior to operation.
3. It is a must to check whether the plug or the clip is firmly fixed, andreplace the loose connecting line of soft pole plate with new one.
4. Insert the plug of the connecting line of the soft pole plate into the corresponding output plug jack, and clamp the soft pole plate with the other end of the clip.
5. Operational Environment
   Temperature: 5-40℃
   Relative Humidity: ≤80%
6. It is proposed that the product should be cleaned with medical tampon dipped with 70% alcohol for medical purpose during the operation

Note:

Please do not immerse the product in the detergent or sterilizingagent solution when performing the cleaning and disinfection

Nipper Connecting Line

Directions for Use

1. This product can be used to connect the principal high frequencyelectric scalpel machine and nipper.
2. It should subject to formaldehyde fumigation prior to operation
3. It is a must to check whether the plug or the plug jack is firmly fixed,and replace the loose connecting line of soft pole plate with new one
4. Insert the plug of nipper connecting line and the other end into the corresponding plug jack and nipper respectively.
5. Operational Environment
   Temperature: 5-40℃
   Relative Humidity: ≤80%
6. It is proposed that the product should be cleaned with medicaltampon dipped with 70% alcohol for medical purpose during the operation

Note:

Please do not immerse the product in the detergent or sterilizingagent solution when performing the cleaning and disinfection

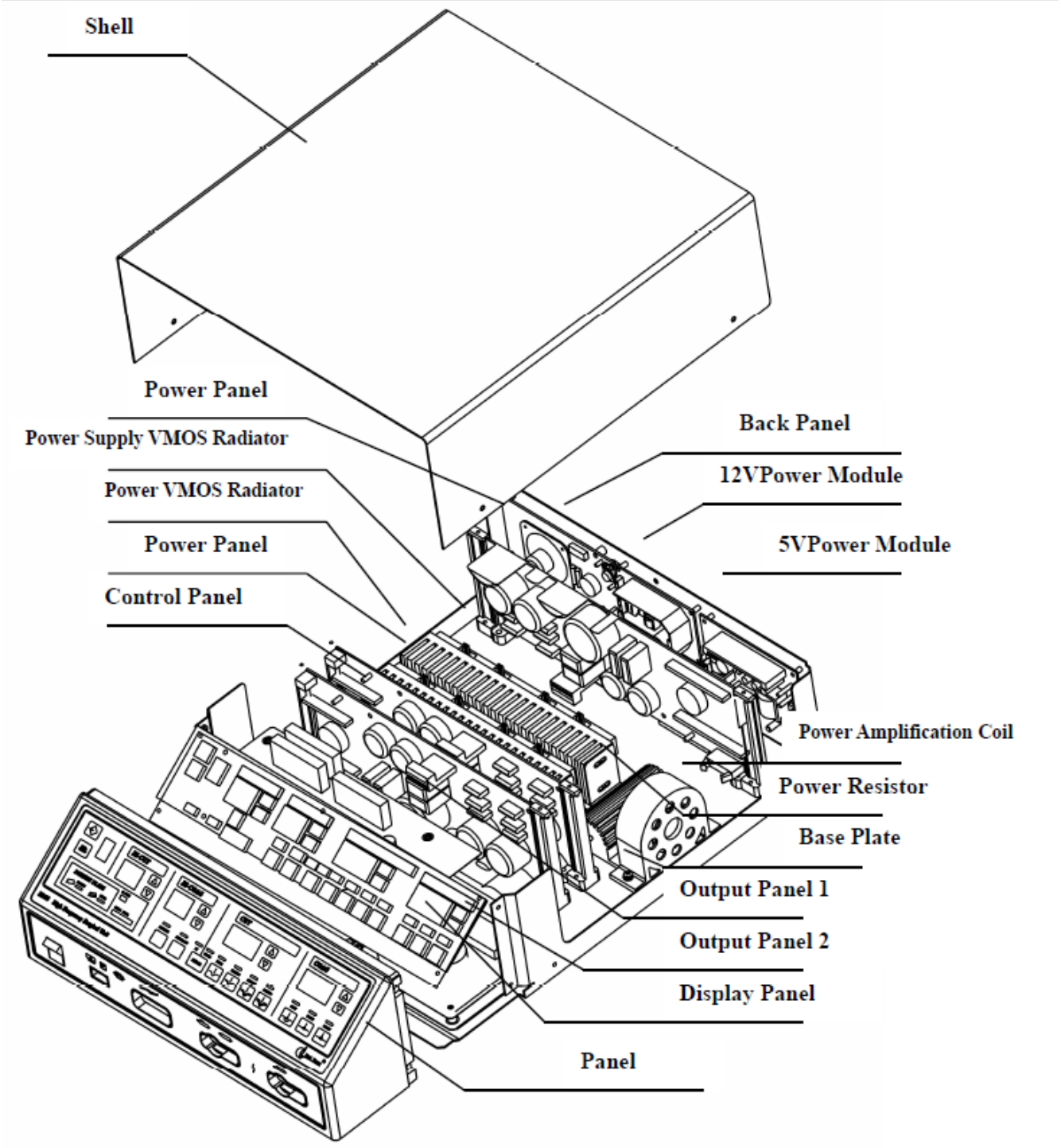
Part 2

Internal Structure

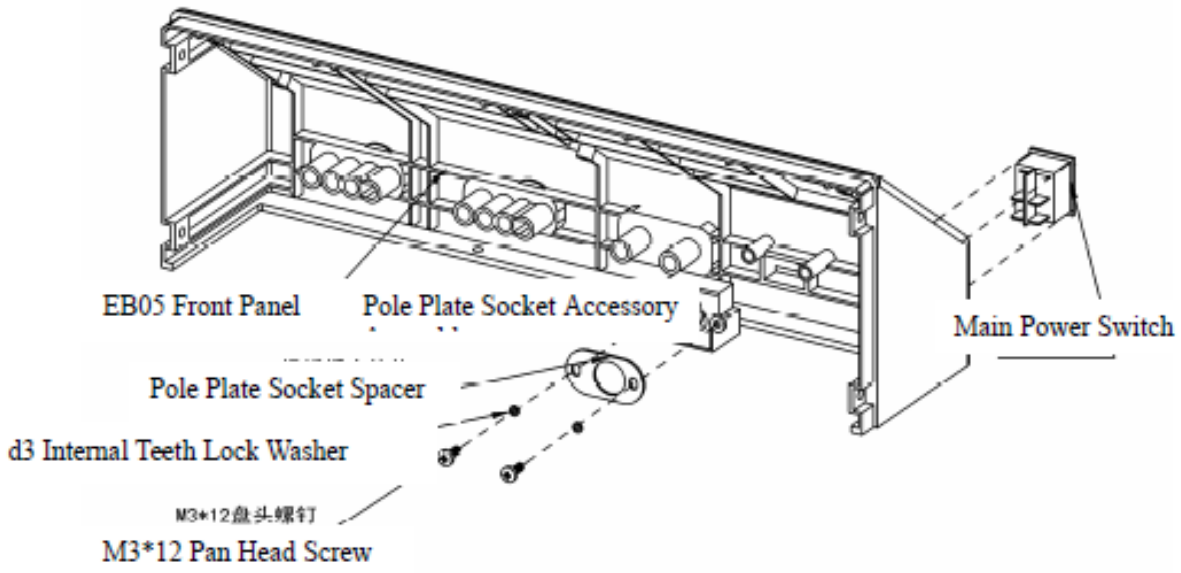
This part includes the following four sections:

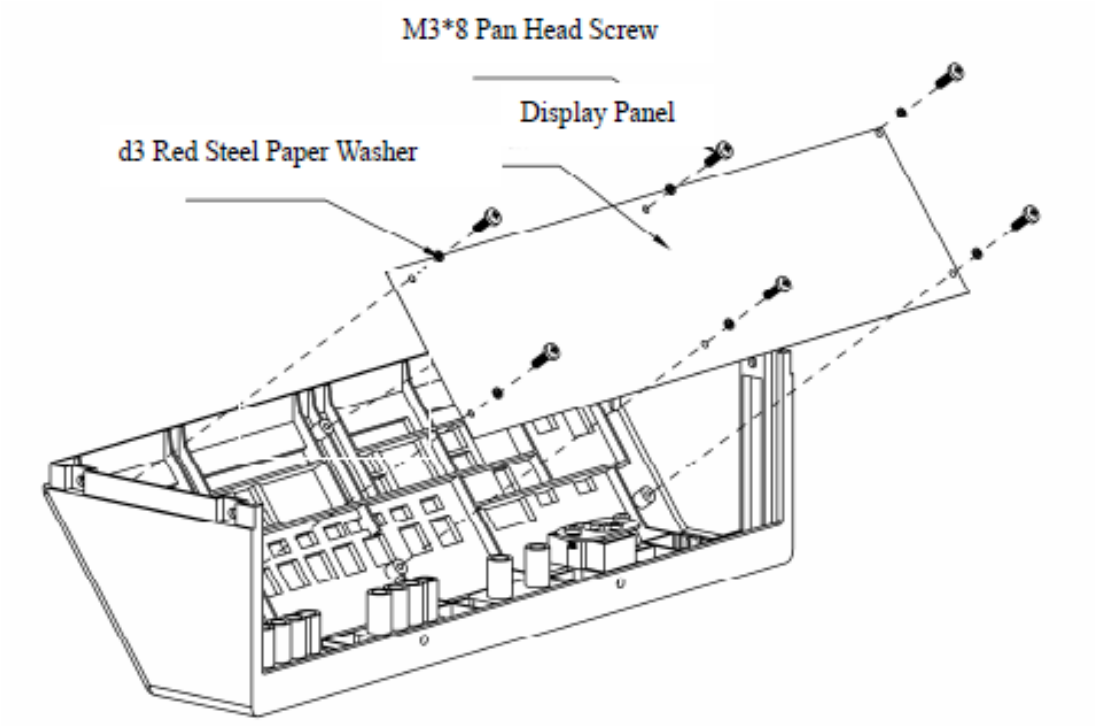
- Integral Structure
- Panel Installation
- Base Plate Installation
- Diagram for Integral Machine

Integral Structure



Panel Installation





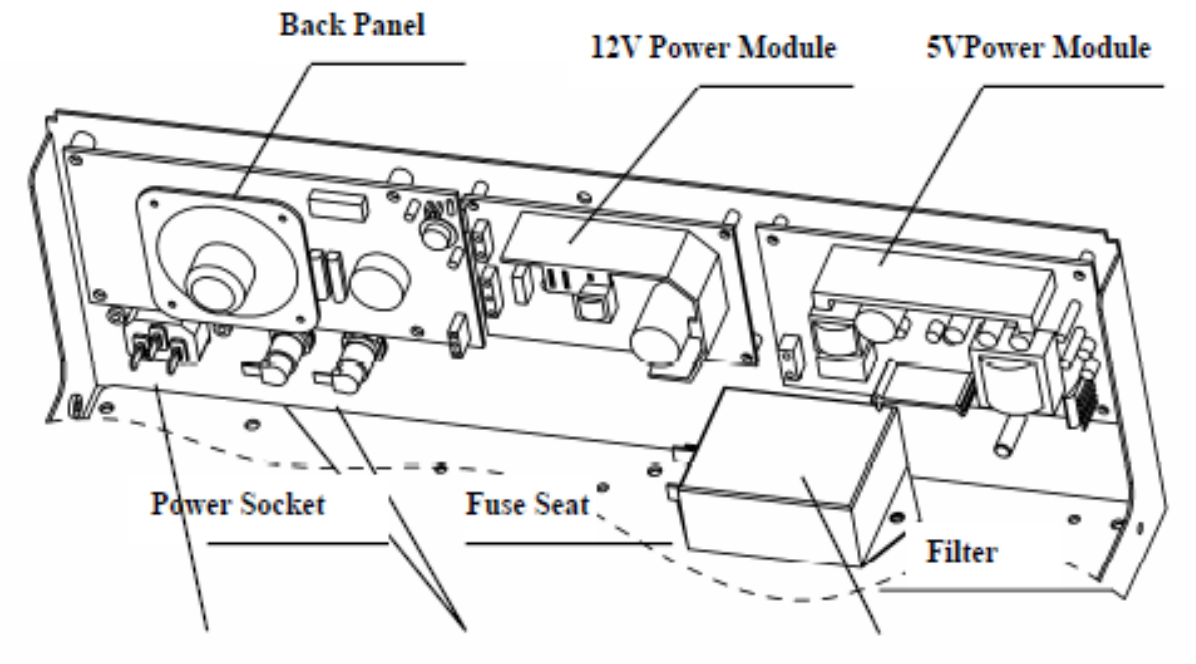
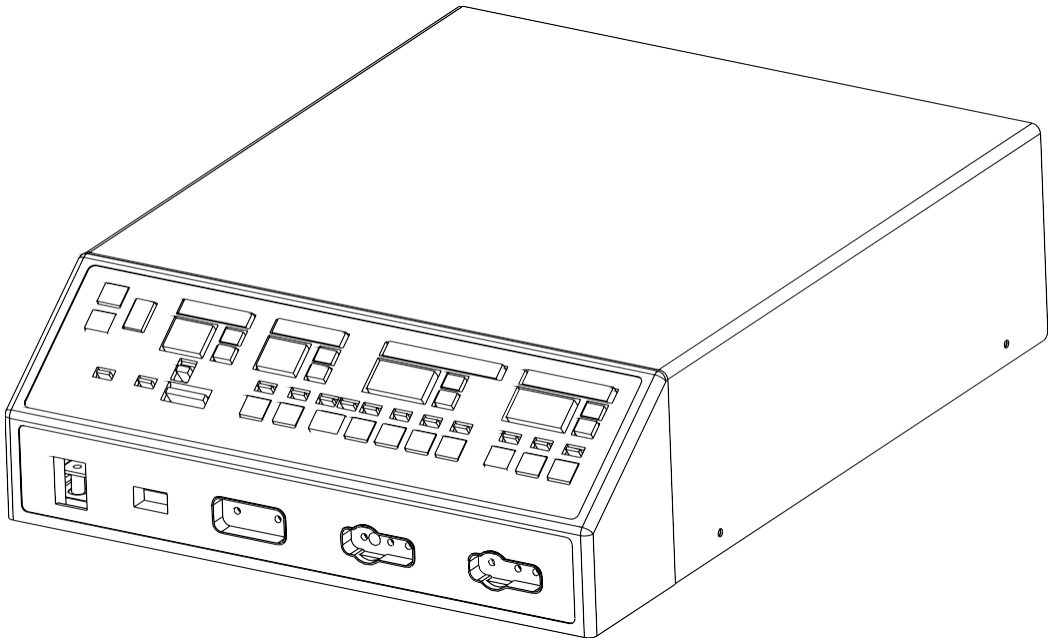


Diagram for Integral Machine



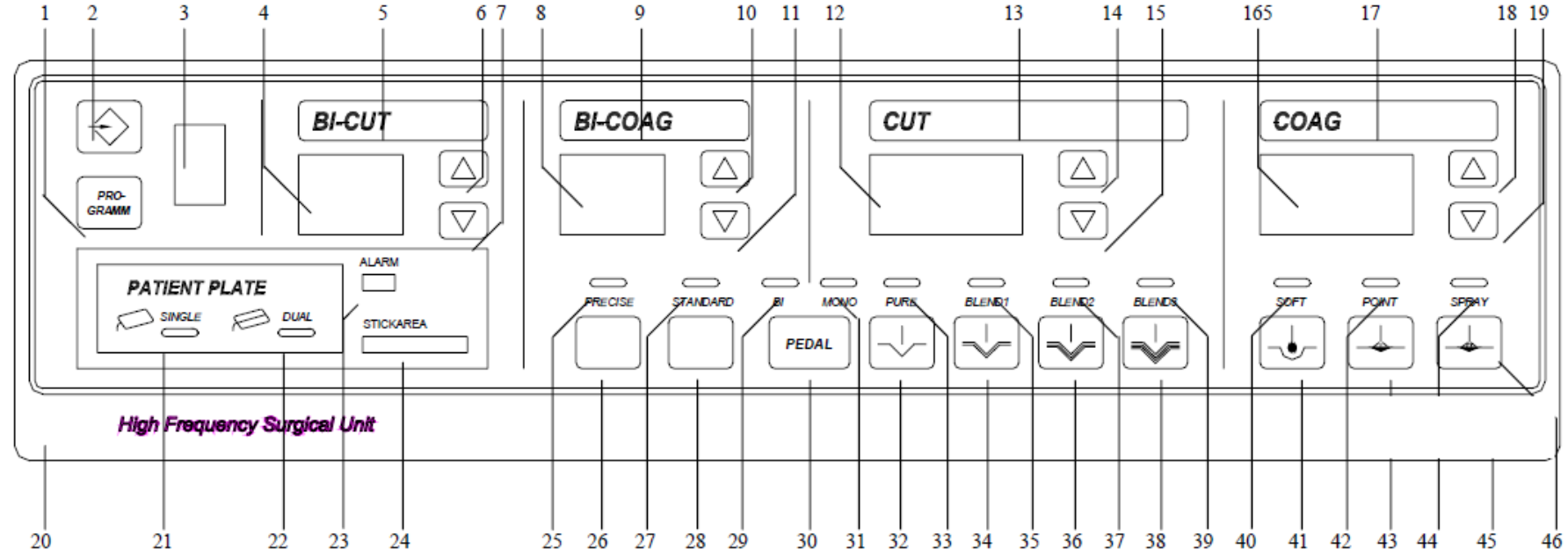
Part 3

Introduction to Panel

This part includes the following three sections:

- Introduction to Control and Display Area
- Introduction to Accessory Junction Area
- Introduction to Back Panel

Introduction to Control and Display Area



User's Application Status

1 System Initiation Mode Programming Key

2 System Initiation Mode Setting Key

3 System Initiation Mode Number DisplayWindow

4 Double Pole Cutting Power Set ValueDisplay Window

5 Double Pole Cutting Start-up IndicatorLamp

6 Double Pole Power Setting Increment Key

7 Double Pole Cutting Power SettingDecrement Key

8 Double Pole coagulation Set Value Display Window

9 Double Pole Coagulation Start-up IndicatorLamp

10 Double Pole Coagulation Power Setting Increment Key

11 Double Pole Coagulation Power Setting Decrement Key

12 Single Pole Cutting Power Set ValueDisplay Window

13 Single Pole Cutting Start-up Indicator Lamp

14 Single Pole Cutting Power Setting Increment Key

15 Single Pole Cutting Power Setting Decrement Key

16 Single Pole Coagulation Power Set Value Display Window

17 Single Pole Coagulation Start-up IndicatorLamp

18 Single Pole Coagulation Power Setting Increment Key

19 Single Pole Coagulation Power Setting Decrement Key

20 Equipment Model

21 Single Pole Plate Mode Indicator Lamp

22 Double Pole Plate Mode Indicator Lamp23

Alarm Indicator Lamp

24 Pole Plate Affixing Area Display Window(Light Arrangement Window)

25,26 Double Pole Precise Coagulation Mode Indicator Lamp and Selector Key

27,28 Double Pole Typical Coagulation Mode Indicator Lamp and Selector Key

29 Foot Switch Double Pole Operation Indicator Lamp

30 Foot Switch Working Mode Selector Key

31 Foot Switch Single Pole Operation IndicatorLamp

32,33 Simple cutting Mode Selector Key and Indicator Lamp

34,35 Mixed Cutting 1 Mode Selector Key and Indicator Lamp

36,37 Mixed Cutting 2 Mode Selector Key and Indicator Lamp

38,39 Mixed Cutting 3 Mode Selector Key andIndicator Lamp

40,41 Soft Coagulation Mode Indicator Lampand Selector Key

42,43 Point Coagulation Mode Indicator Lampand Selector Key

44,46 Surface Coagulation Mode IndicatorLamp and Selector Key

45 Trademark

Cross Reference List of Debugging and Application Statuses

No.	Application Status	Debugging Status
2	System Initiation Mode Setting Key	Feedback signal indicating switching between main and feedback CPU.
3	System Initiation Mode Number Display Window	Feedback Signal Display Window （U，I，P，u，r）
4 8	Double Pole Power Set Value Display Window Double Pole Coagulation Set Value Display Window	Feedback Value Display Window
6 7	Double Pole Cutting Power Setting Increment Key Double Pole Coagulation Power Setting Decrement Key	Feedback Signal Switching Key (switching between U，I，P，u and r)
26 28	Double Pole Precise Coagulation Mode Selector Key Double Pole Typical Coagulation Mode Selector Key	Setting Mode Switching Key
14 15	Single Pole Cutting Power Setting Increment Key Single Pole Cutting Power Setting Decrement Key	Set Point Selector Key (0-9)
12	Single Pole Cutting Power Set Value Display Window	Set Point Position Display Window
16	Single Pole Coagulation Power Set Value Display Window	PWM Display Window
32	Simple Cutting Mode Selector Key	Setting Mode Selector Key (current, power)
34	Mixed Cutting 1 Mode Selector Key	Switching between Feedback AD Value and Measured Value
41	Soft Coagulation Mode Selector Key	Power Setting Key
18 19	Single Pole coagulation Power Setting Increment Key Single Pole Coagulation Power Setting Decrement Key	PWM AD Value Increment Key PWM AD Value Decrement Key

Description of Debugging Status

Debugging Status Access Mode:

Switch on the machine and press and hold the double pole precisecoagulation mode selection key and soft coagulation mode selection key for 5 seconds.

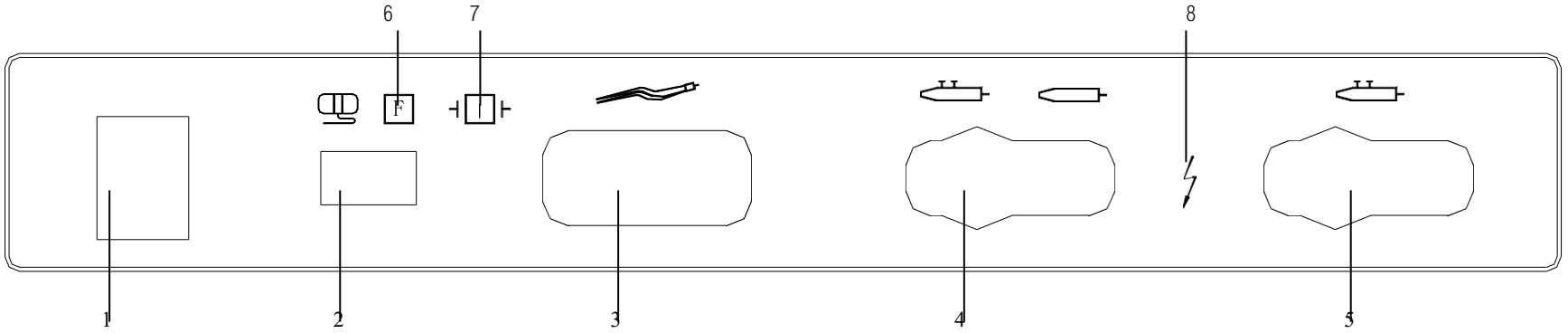
Debugging Status Function:

a. It will produce a continuous PWM which is used to test the control panel, power supply panel and power panel.
   The single coagulation display window will display a continuous PWM value which can be changed by pressing the single coagulation power setting increment key or decrement key. At the time of initiation, the main CPU will send out a set PWM value.
b. The feedback value indicating the voltage, current, power, node and affixing area is used to check whether the machine is in normal operation.
c. It will set the accurate power for the user's application status (for detail, please refer to Part 6).

Specific Application of Feedback Value

a. At debugging status, the system initiation mode number display window indicates types of various feedback signals. By pressing the double pole power setting increment or decrement key to make switch between U, I, P, u, and r, the double pole cutting power set value display window and double pole coagulation power set value display window will display relevant feedback values.
U--- Output feedback voltage.I---
Output feedback current P---
Output feedback power
u--- Mode signal
r--- Affixing area of pole plate
b. Press the system initiation mode setting key to make switch between main CPU and feedback CPU. At the time of initiation, the double pole cutting power set value key display window and double coagulation power set value display window will display the feedback value of main CPU. Once the system initiation mode setting key is pressed, the feedback signal displayed in the system initiation mode number display window will flash. At this point, the double pole power set value display window and double pole coagulation power set value display window will display the feedback value of feedback CPU.
c. Value of feedback voltage, current or power varies in line with the variation of PWM and load. However, the variation of mode signal as well as the pole plate affixing area is so limited.
d. It is applicable to make switch between feedback AD value andmeasured value by pressing and holding the mixed cutting 1 mode selector key for 2 seconds. At the time of initiation, the double pole cutting power set value display window and double coagulation power set value display window will display feedback values. Once the mixed cutting 1 mode selector key is pressed, a decimal point will be added to the feedback signal displayed in the system initiation mode numberdisplay window. At this point, measured values will be displayed in the double pole cutting power set value display window and double coagulation power set value display window.

Introduction to Accessory Junction Area



1 Power Switch

2 Pole Plate Socket

3 Nipper socket

4 Single Pole Output Channel 1（manual control scalpel 1and foot control scalpel socket）

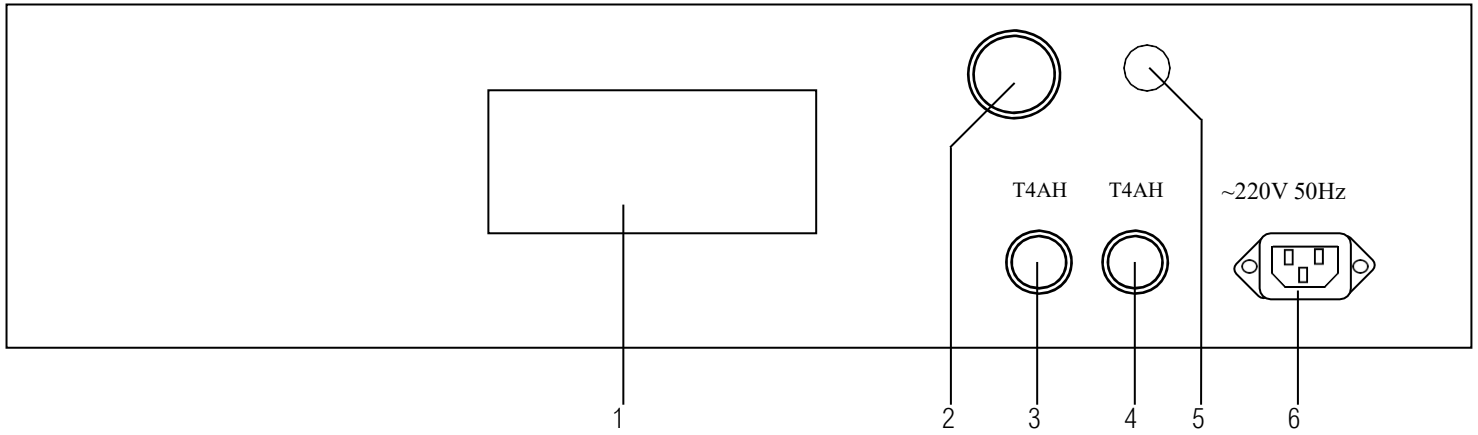
Single Pole Output Channel 2 (socketof manual control scalpel 2)

F Full Suspension Tuning Balance Output

7 CF De-quiver Equipment

8 It means that all output socketspossess hazardous high voltage.

Introduction to Back Panel



1	Nameplate
2	Foot Switch
3 ， 4	4A Fuse Protector
5	Volume Tuning Knob
6	Power Socket

Part 4

Technical Parameters

This part includes the following four sections:

- Maximum Output Parameter
- Load Curve
- Output Power and Peak Value Curve of OpenCircuit Voltage
- Safety Indexes

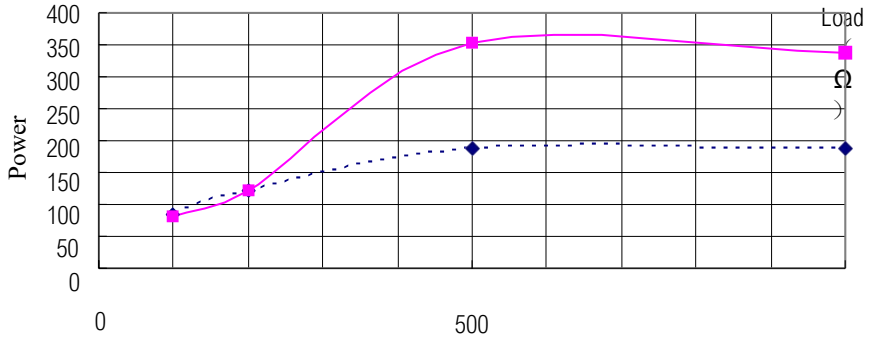
Maximum Output Parameter

WORKING MODE		MAXIMUM POWER （W）	RATED LOAD （Ω）	MAXIMUM OPEN CIRCUIT VOLTAGE PEAK VALUE （V）
Single Pole Cutting	Simple Cutting	400	500	2300
	Mixed Cutting 1	300	500	2700
	Mixed Cutting 2	200	500	3200
	Mixed Cutting 3	150	500	3700
Single Pole Coagulation	Soft Coagulation	120	500	3400
	Point Coagulation	100	500	5600
	Surface Coagulation	120	500	7250
Double Pole	Double Pole Cutting	70	500	1450
Double Pole	Precise Coagulation	70	200	360
	Typical coagulation	70	500	240

Load Curve

The following chart shows the curve line of output power P at full power and half power settingsin various modes, which changes with load R_L (the full power and half power is respectively indicated with solid line and dash line)

a. Simple Cutting (not applicable when the load is below 100Ω)

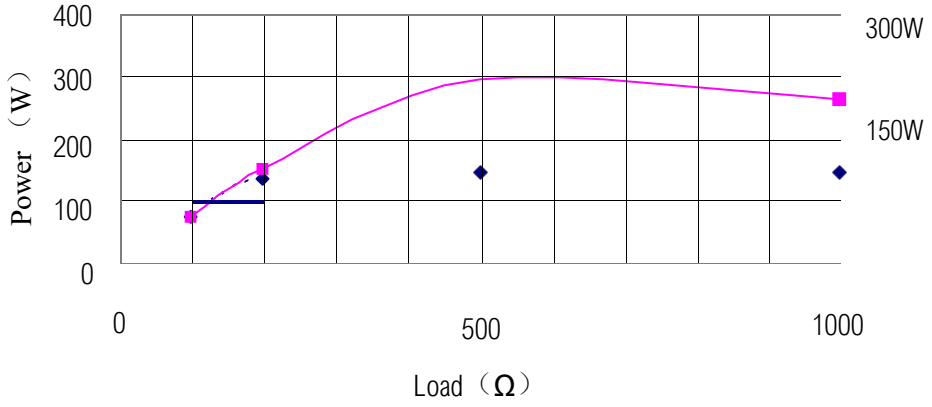


400W

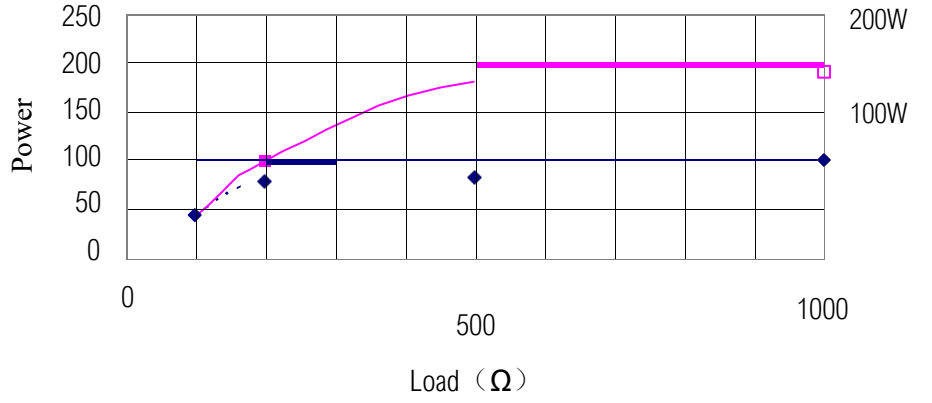
200W

2
1

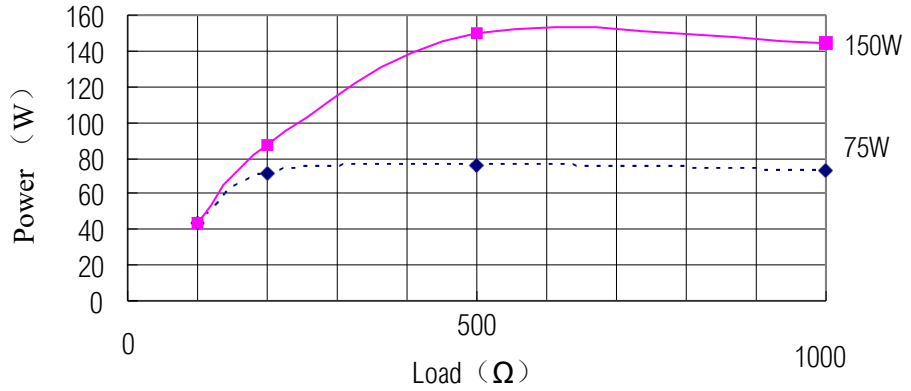
b. Mixed Cutting 1（not applicable when the load is below100Ω）



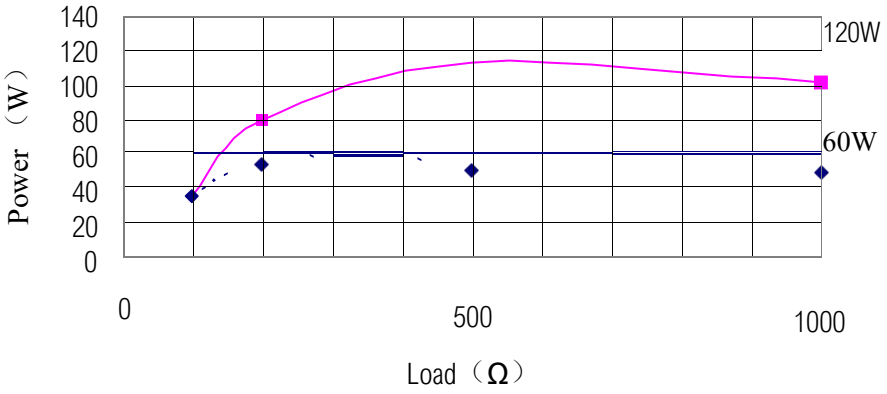
c. Mixed Cutting 2（not applicable when the load is below100Ω）



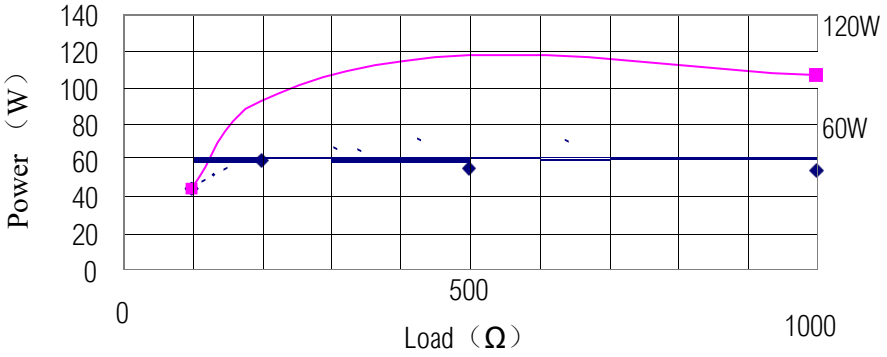
d. Mixed Cutting 3（not applicable when the load is below100Ω)



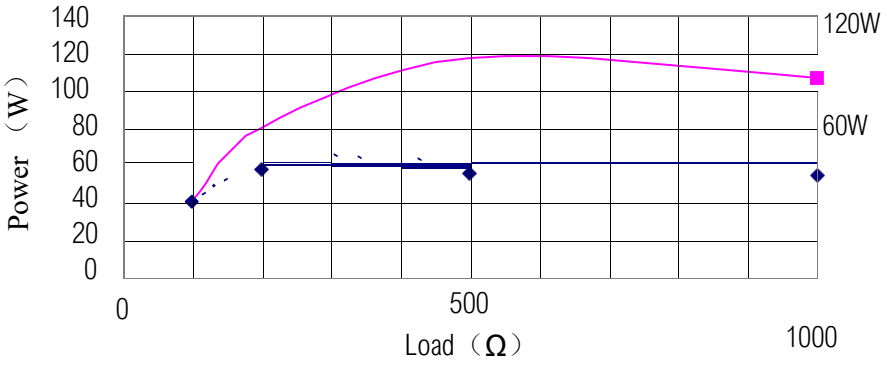
e. Soft Coagulation(not applicable when the load is below 100 Ω)



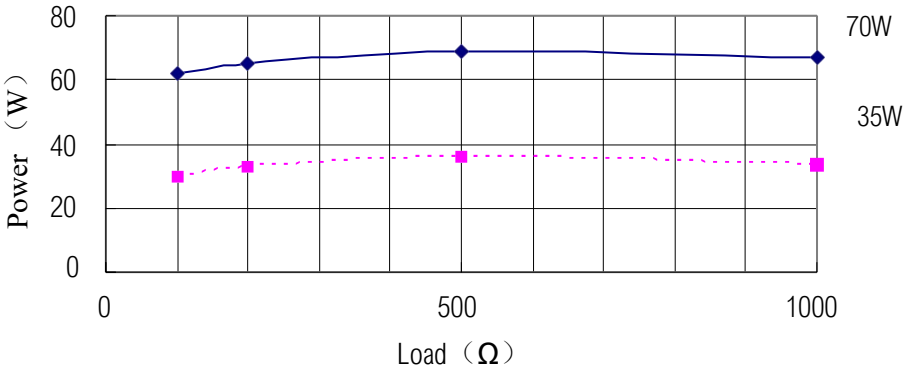
f.Point Coagulation(not applicable when the load is below100Ω)



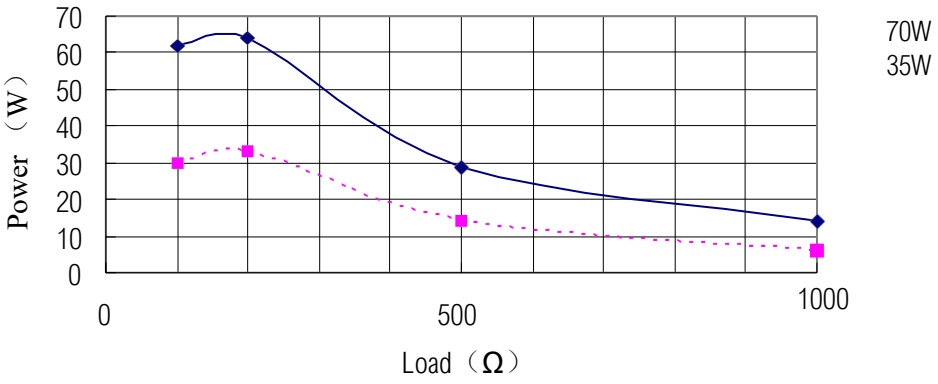
g. Surface Coagulation (not applicable when the load isbelow 100Ω)



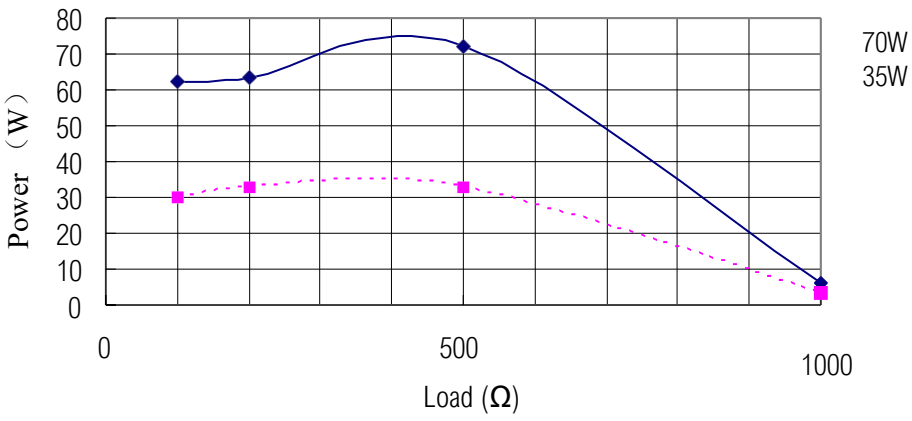
h.Double Pole Cutting (not applicable when the laod is below100Ω)



g.Double Pole Precise Coagulation (not applicable when theload is below 100Ω)

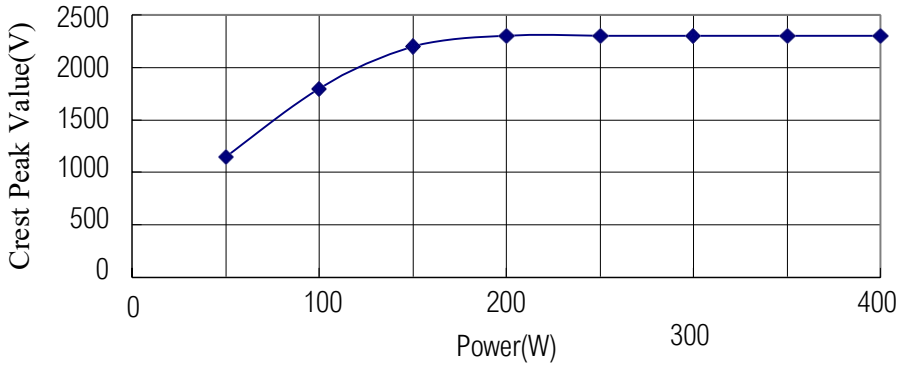


i. Double Pole Typical Coagulation (not applicable when theload is below 100Ω)

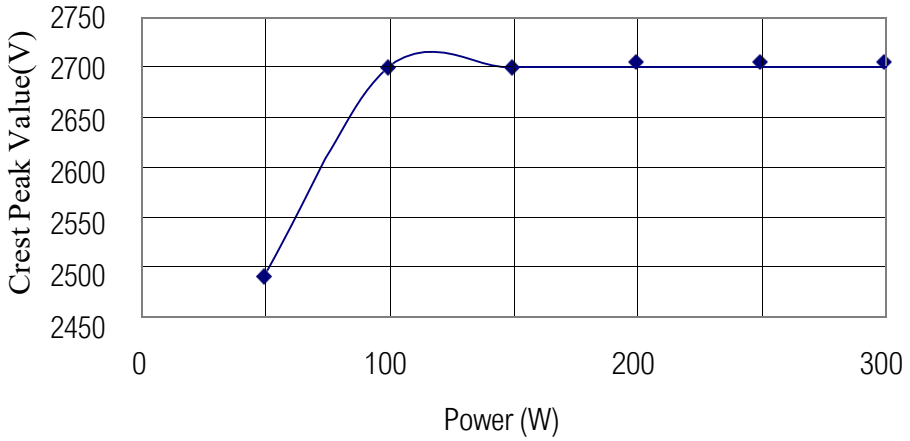


Output Power and Open Circuit Voltage Peak Value curve

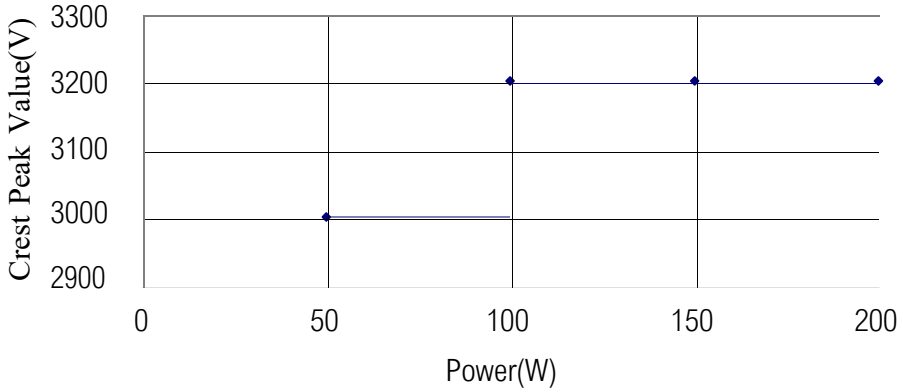
a. Simple Cutting



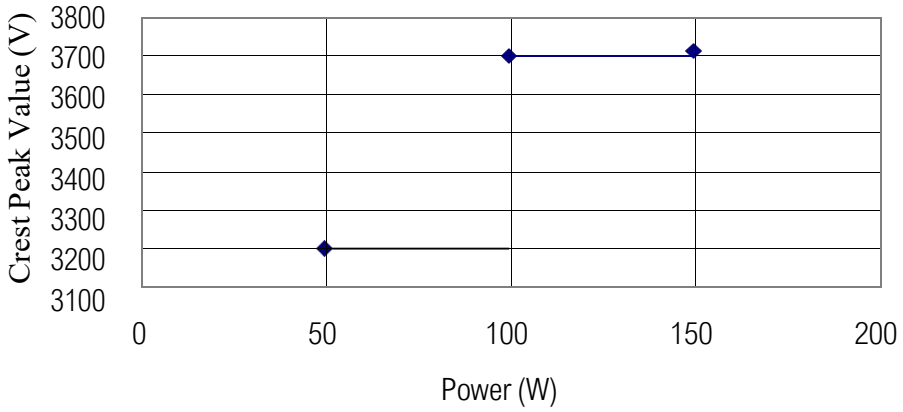
b. Mixed Cutting 1



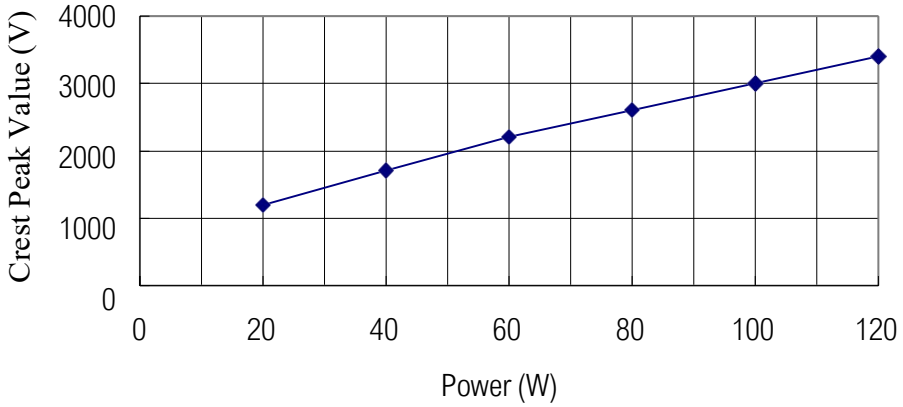
c. Mixed Cutting 2



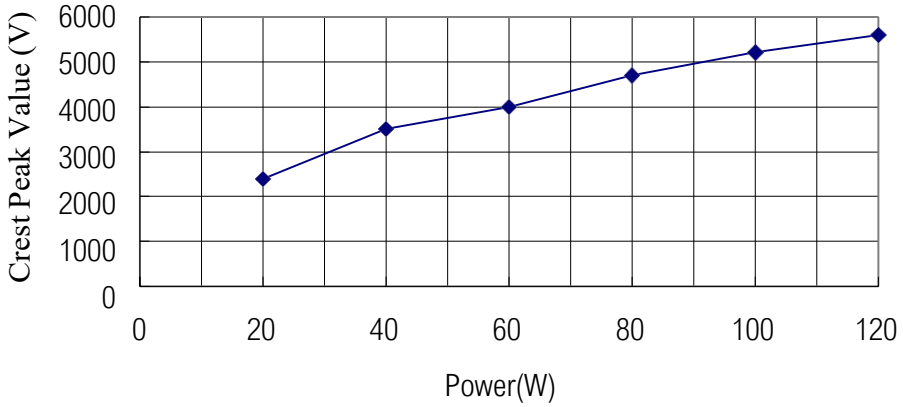
d. Mixed Cutting 3



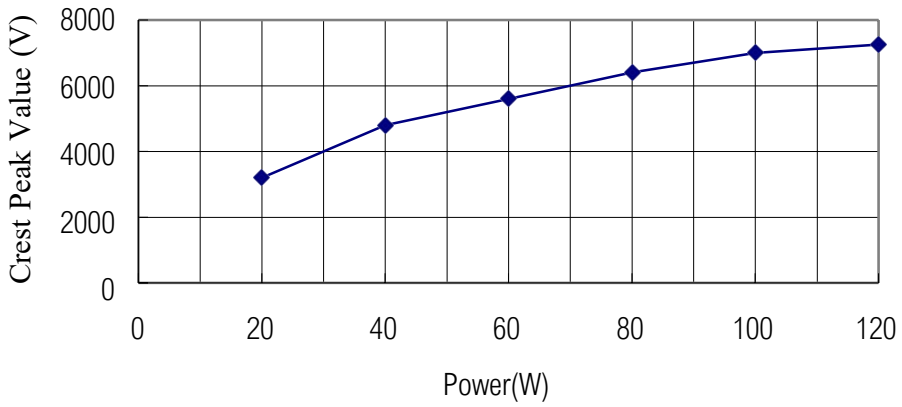
e. Soft Coagulation



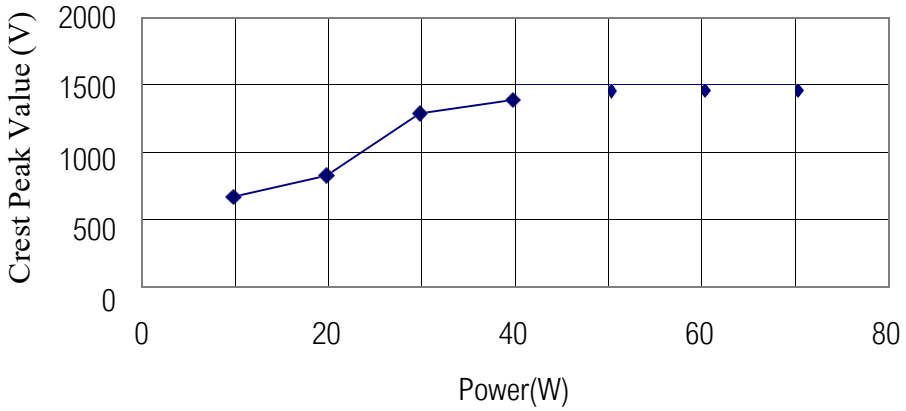
f.Point Coagulation



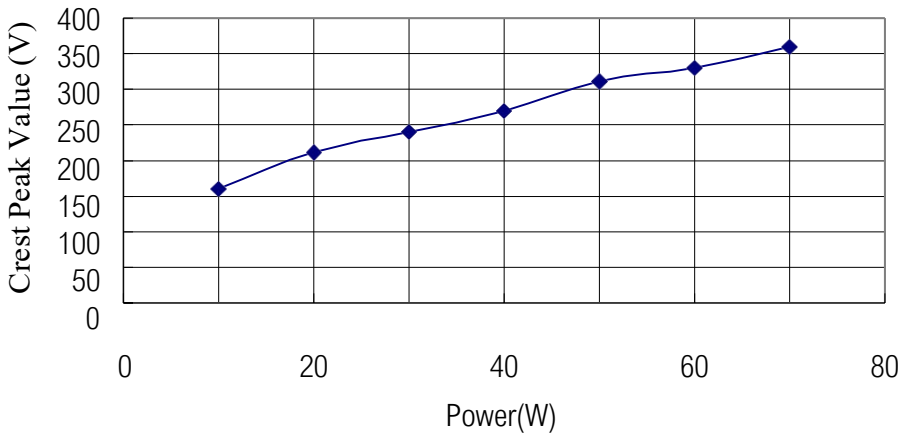
g. Surface Coagulation



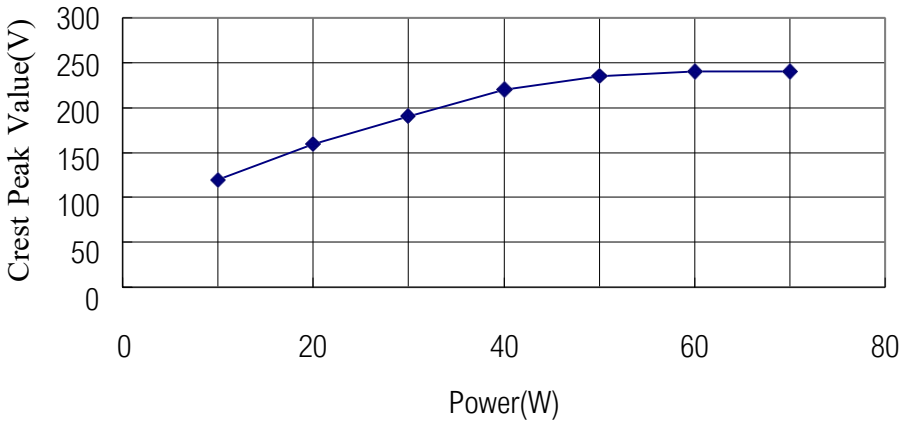
h.Double Pole Cutting



i.Double Pole Precise Coagulation



j.Double Pole Typical Coagulation



Safety Indexes

1. **Pressure Endurance** (It shall be deemed as being qualified if it subject to 5mA excessive creepage for 1 minute without any punch-through or flash)

No.	Item Tested
1	Grounded Network Power Supply: AC1500V
2	Grounded Shell Insulating Parts: AC4000V
3	Grounded Single Pole Surgery Electrode: AC4700V
4	Single Pole Surgery Electrode to Network Power Supply: AC5600V
5	Grounded Neutral Electrode: AC4700V
6	Neutral Electrode to Network Power Supply: AC5600V
7	Grounded Bipolar Electrode: AC3000V
8	Bipolar Electrode to Network Power Supply: AC4200V

2. Low Frequency Creepage Current (mA)

		Normal Status	Single Failure Status
Grounded Creepage Current		<0.5	<1
Shell Creepage Current		<0.1	<0.5
Patient Creepage Current		<0.01	<0.05
Patient Auxiliary Creepage Current	DC	<0.01	<0.05

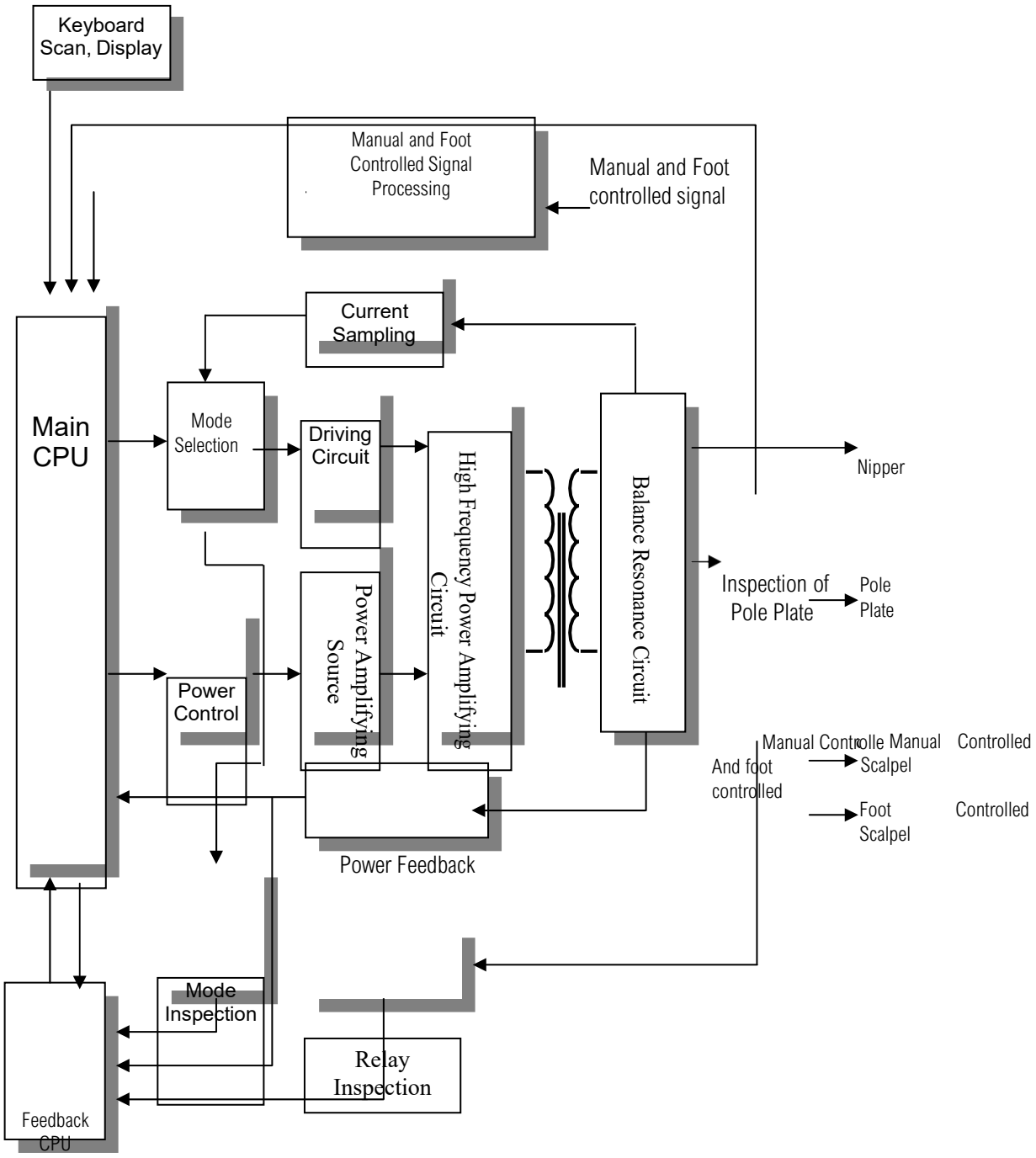
Part 5

Operating Principle

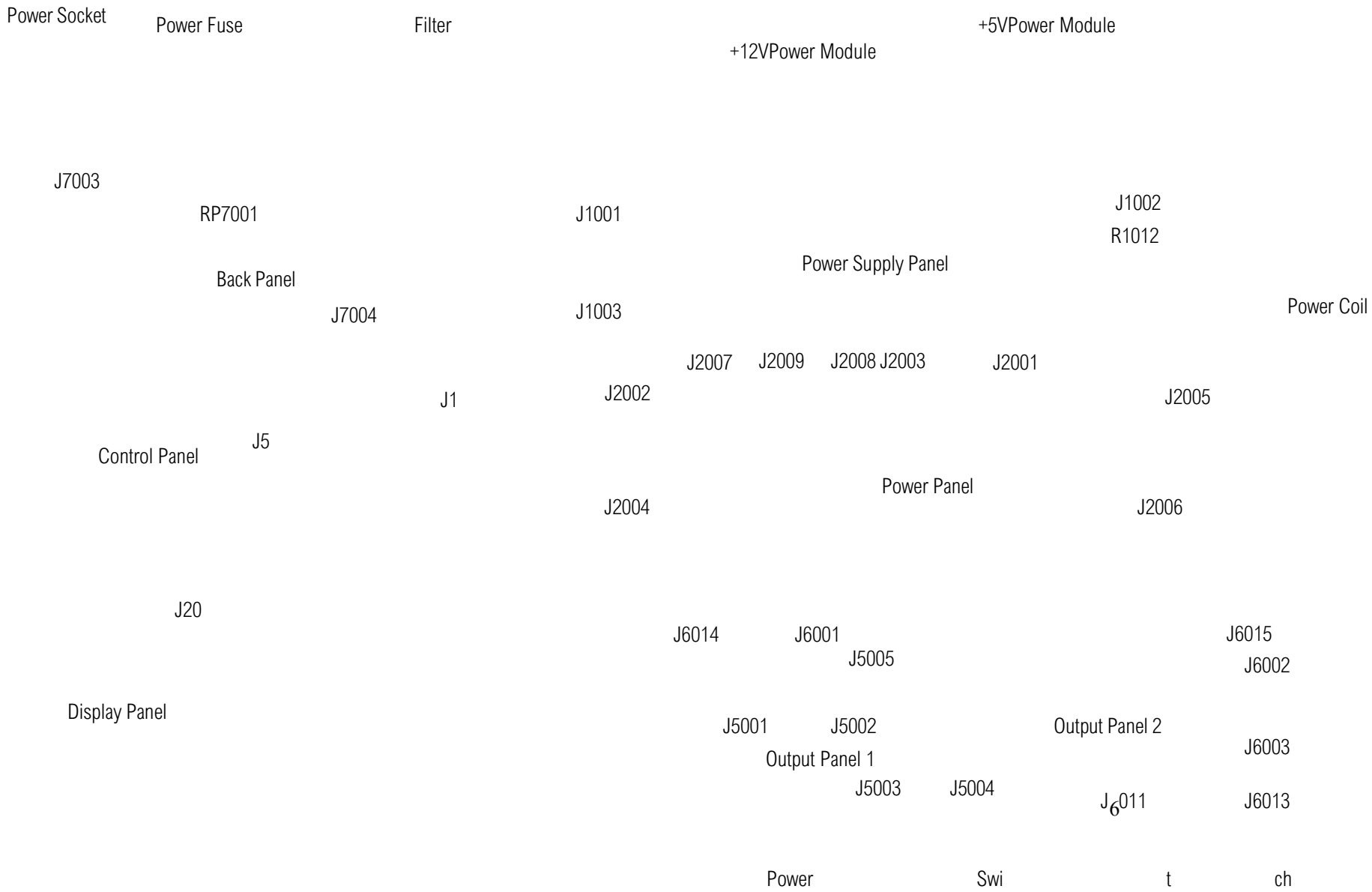
This part includes the following three sections:

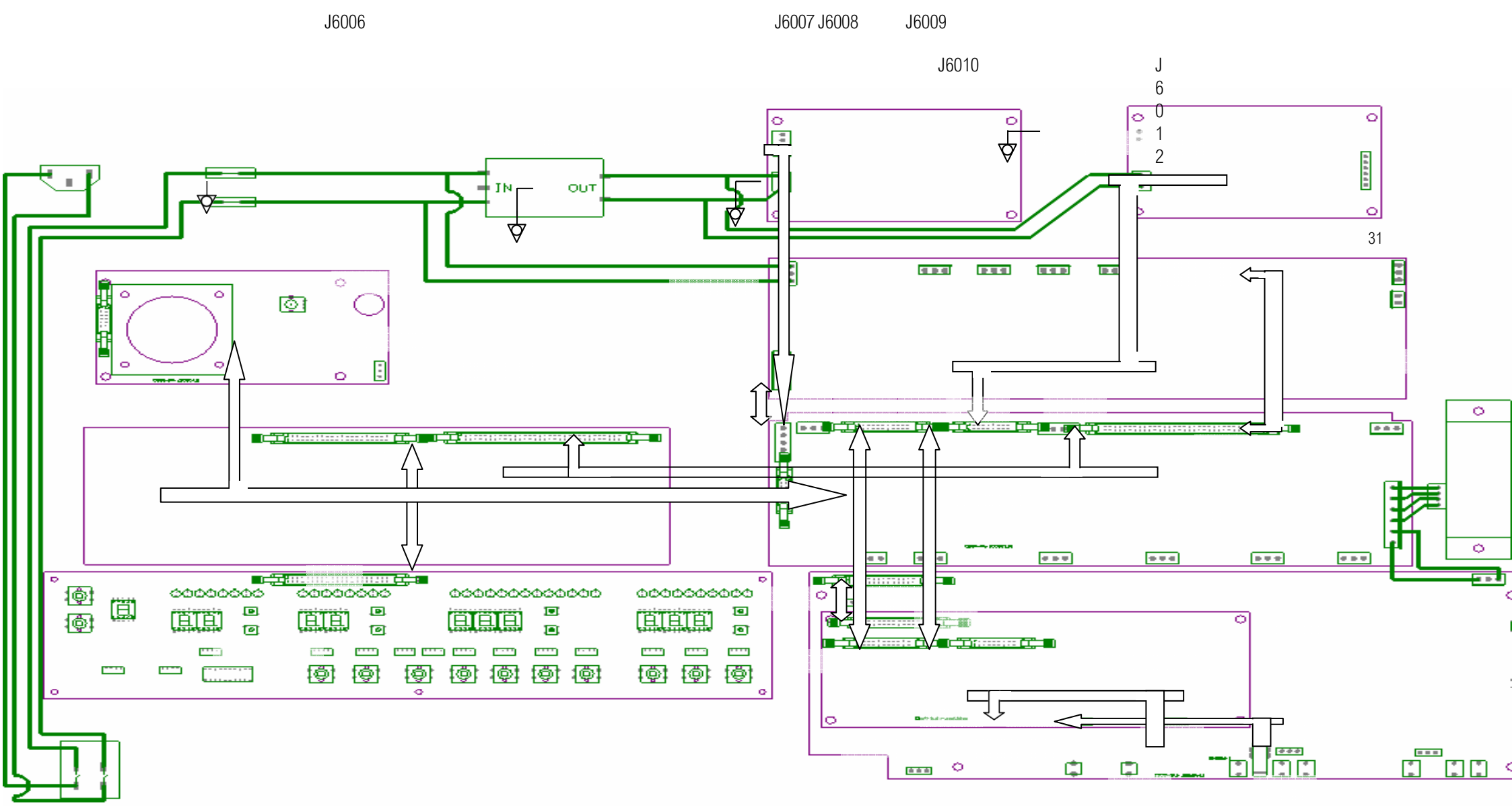
- Block Diagram for Principal Machine
- Wiring Diagram for Integral Machine
- Theoretical Description
- Introduction to Principle of Subsidiary Panel

Block Diagram for Principal Machine



Wiring Diagram




J6006
J6007 J6008
J6009
J6010
J
6
0
1
2
IN
OUT
31

Theoretical Description

Press the POWER (power supply control) button to switch on the power. At this point, the electric scalpel is at stand-by status, and the control circuit is under the control of operators (mode, power and so on).During the progress of stand-by and operation, the main CPU will continuously detect the pole plate signal. In case of broken circuit or other abnormal condition occurs to the pole plate, the main CPU will give out alarm to prohibit the start-up. If the pole plate signal is normal, the control panel will send a mode signal, a pulse width modulation signal and a sound indicating signal(not provided in the diagram) to the power panel. After receiving the mode signal from the control panel, the power panel will send a modulation signal of certain cycle and width through the mode selection and by producing a circuit. This signal willbe transmitted to the impulse circuit for amplification prior to being converted to power amplifying grid signal through high frequency transformer. At the same time, the control panel will send out pulsewidth modulation power signal which is corresponding to the set power to the power panel. Through the amplification by the switching circuit and high frequency transformer, a stable and isolated DC current can be provided. Furthermore, the output terminal is also equipped with a current sampling circuit, through which, the sampled signal will be transmitted to the control switch circuit of comparator to limit the short circuit current.

During the power output of electric scalpel, the main CPU and the monitoring CPU will perform real-time inspection of the high frequency voltage, current and power signal from the output terminal so as to realize the safety redundancy. At the same time, with the software computation and compensation, the output power of the electric scalpel will become stable, which is helpful in ensuring the safe and reliable operation of the electric scalpel

Power Supply Panel

Precise Operating Principle

The major function of the power supply panel is to make use of the principle of switching power supply to provide power amplification power. It receives a PWM signal from the control panel, and coverts intoDC signal which is to be sent to the U1004 (UC3825 High Speed PWM Controller) so as to produce two parallel alternating square waves. Driven by the U1002 and U1003 (7667), the two square waves shall be transmitted to the coil T1001 and T1002 which are used to drive 4 VMOS tubes (IRF840). Furthermore, the 220V AC voltage passing through the bridge rectifying circuit (BR1001) and filter circuit canobtain a DC voltage, which shall be switched into conduction with 4 VMOS tubes (840) by turns prior to the output from the transformer T1001. It will be converted into DC voltage through the bridge rectification by diode (U860) and output amplification by L and C filter.

Interface Description

J1001：~230V Input

J1002：Power amplifying DC voltage output, connected with powerpanel J2005

J1003： Connected with power panel J2002J1005

，J1006： Short circuit plug

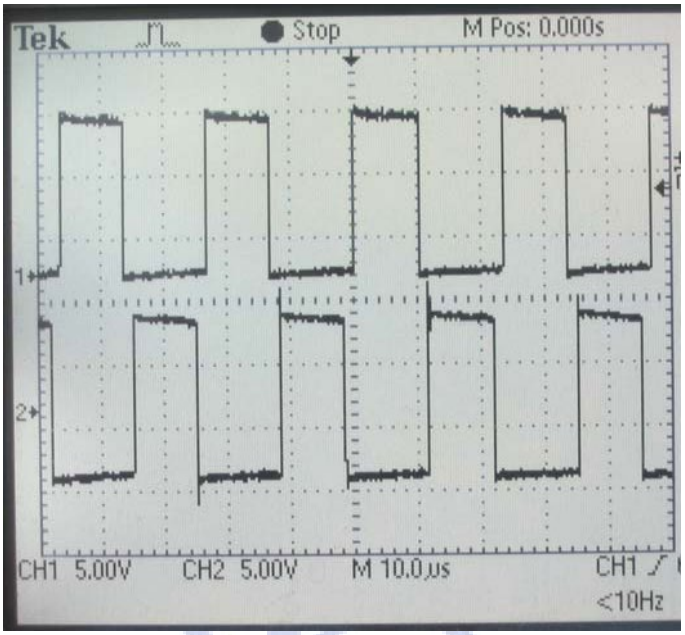
R1012： Load resistor installed on the（470Ω）base plate. M1001~M1004： VMOS tube （IRF840）on the large-size radiator.

For diagram for printing panel, please see appendix.

Functional Detection

1. The J1001 (~230Vplug) should be pulled out prior to the detection of waveform.
2. Detect the two alternating square waves produced by the UC3825high-speed PWM controller.

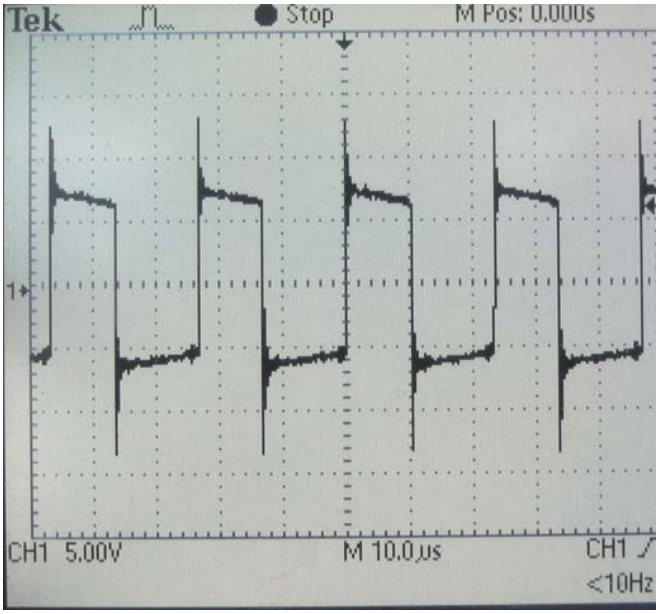
Make use of the dual trace oscilloscope to observe the testingpoints---TP1018 and TP1019 as indicated in the following diagram.

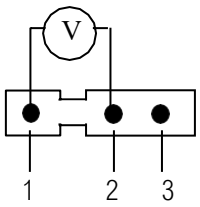


Waveform: Alternating Square Wave, Overlapped high levelis unacceptable.

3. Driving Waveform of VMOS Tube.

Observe the g-s waveform of 4 VMOS tubes as indicated in thefollowing figure with oscilloscopes.





4. Connect the J1001 (~230Vplug), pull out the short circuit of J1005 and make use of the multi-meter to measure pin 1 and 2 (1 refers to grounding pin, and the span of the multi-meter shall be higher than DC 200V) of J1005.
5. Switch on the machine to enter the power setting debugging status, initiate simple cutting, and the voltage value will increase with the increment of AD value of the PWM until it reaches 200V.

Function of J1005 short circuit plug: Pin 2 and 3 of J1005 in short circuit are used to send the power from the switch power source to the power amplifying circuit. When the short circuit plug is pulled out, it isapplicable to check whether the switch power source is in normal operation.

Control Panel

Precise Operating Principle

The major functions of the control panel are performed by two CPU.UD1 is the main control chip, of which, the major function is to receive start-up signal and pole plate mode signal, send out mode signal and control the power signal of PWM, control various lights through manipulating the 7219 on the display panel and scan the keyboard. Furthermore, the main control CPU is also used to receive power, voltage and current feedback signals and control the final power output. UD2 is the feedback chip, of which, the major function is to receive the feedback signals from the relay as well as power, voltage and current feedback signals. It will give alarm in case of emergency. The control panel aims to perform the AC/DC conversion of voltage and current feedback from the output panel through AD536, and produce the power value through AD633. The control panel is equipped with pole plate detecting circuit. Any signal transmitted from the control panel to the power panel is isolated via the photo-coupler 521.

Interface:

J1： To be connected with power panel J2001.J5： To be connected with display panel J20.
For diagram for printing panel, please see appendix.

Functional Detection

1. Each key of the display panel and display are normal.
2. Pole plate affixing area indication is normal (for detail, please seepart 6).
3. Current, voltage, power and mode signal feedback is normal (fordetail, please see part 6).
4. PWM signal is normal.

○ Pull out the J1005 short circuit plug from the power supply panel, and makes of the multi-meter to measure pin 1 and 2 of J1005 (1 refers to the grounding pin, and the span of the multi-meter should be more than the DC 200V).

○ Switch on the machine to enter the power setting debugging status,initiate simple cutting, and the voltage value will increase withthe increment of AD value of the PWM until it reaches 200V.

Display Panel

Precise Operating Principle

The major function of the display panel is to receive signals from main control CPU of the control panel, and control the display of the nixie light through two MAX7219. The display panel is also equipped with 4 reverse driver of 2803 model which is used to drive various lights and keys.

Interface

J20： Connected with J5 of control panel
For diagram for printing panel, please see appendix.

Functional Detection

1. The display of each nixie light is normal.
2. The indicator lamp is normal.
3. Each key is in normal operation.
4. The start-up indicator lamp flashes when the single coagulation anddouble pole coagulation are initiated.

Power Panel

Precise Operating Principle

The major function of the power panel is to output relevant power tube driving signals in line with the mode provided by the control panel in addition to the power amplifying power and output power from the power supply panel. The power panel has two power output circuits, namely bridge power amplifying circuit and single tube power amplifying circuit. The single-tube power amplifying circuit is applicable to point and surface coagulation modes; whereas, the bridge power amplifying circuit is applicable to other modes. The power panelis also equipped with special circuit which is used to limit the short circuit current and the high frequency creepage current. The power panelwill send a signal to the power supply panel for the purpose of reducing the voltage of the power amplifying circuit in case of excessive short circuit current and high frequency creepage current (except for surface coagulation mode). Similarly, when the high frequency creepage current exceeds the rated value in the surface coagulation mode, it will send a signal to the mode circuit to change the driving signal.

Interface

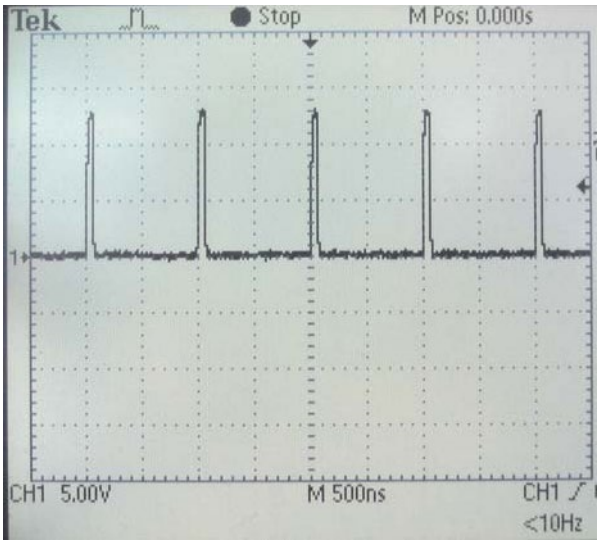
J2001： Connected with control panel J1
J2002： Connected with power supply panel J1003 J2003：
Connected with5V and ±12V power modulesJ2004： Connected
with back panel J7003
J2005： Connected with power supply panel J1002
J2006： Connected with large-size coil and J6015 of output panel 2J2007：
Connected with 12V power module
J2008： Connected with J5002 of output panel 1 J2009：
Connected with J5001 of output panel 1 M2001~M2008：
Connected with large-size radiatorFor diagram for printing
panel, please see appendix.

Functional Detection

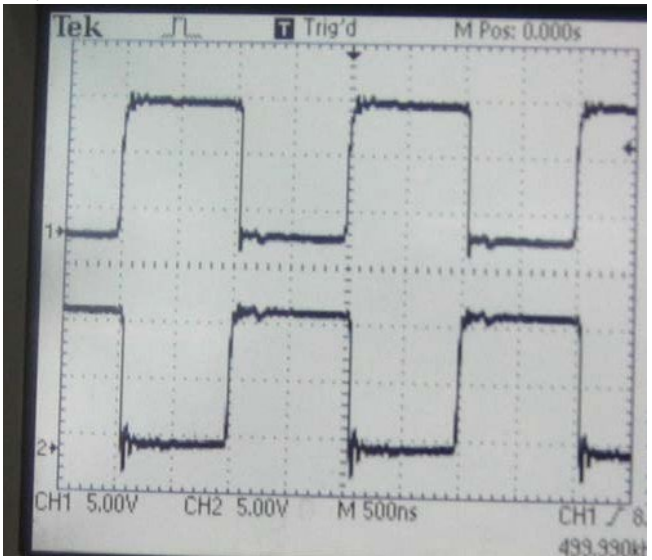
1. Pull out the short circuit plug J1005 from the power supply panel.
2. Detect the driving signal of full-bridge power amplifying circuit.

a. Adjust the full bridge.

○Observe the testing points TP2002 with oscilloscope and adjust the PR2001 so as to make sure that the pulse width is 100ns (as indicated in the following figure).

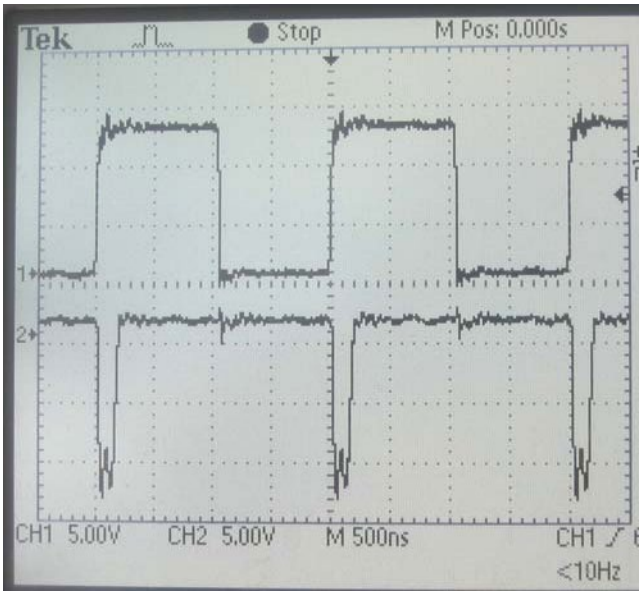


○ Observe the testing pints TP2006 and TP2008 (as indicated in thefollowing figure) with dual trace oscilloscope.



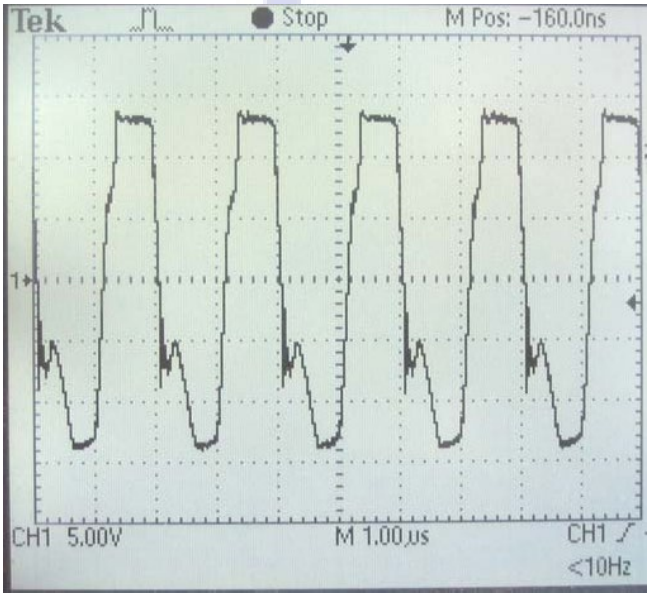
Waveform: Alternating Square Wave, Overlapped high level is unacceptable.

b. Observe the testing pints TP2006 and TP2007 (as indicated in thefollowing figure) with dual trace oscilloscope.



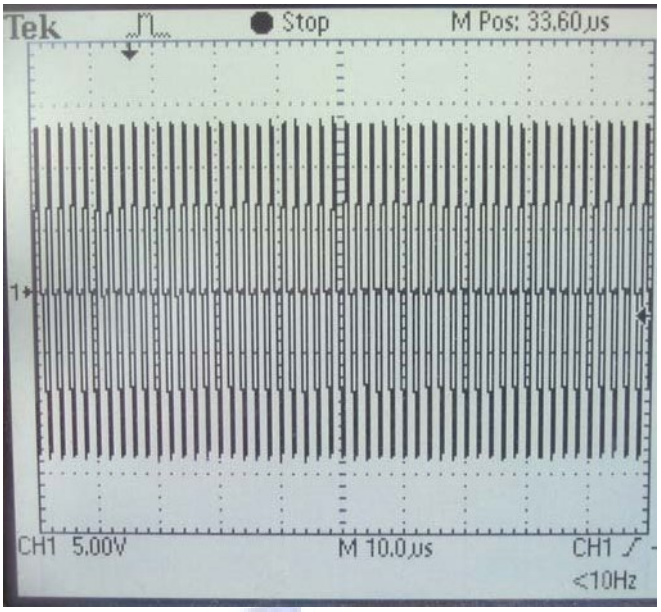
c. Observe the testing pints TP2008 and TP2009 (as indicated in thefollowing figure) with dual trace oscilloscope.

d. Detect the driving waveform of the VMOS tube, initiate the simple cutting and observe the g-s waveform of power tube (P11NM60) with oscilloscope.

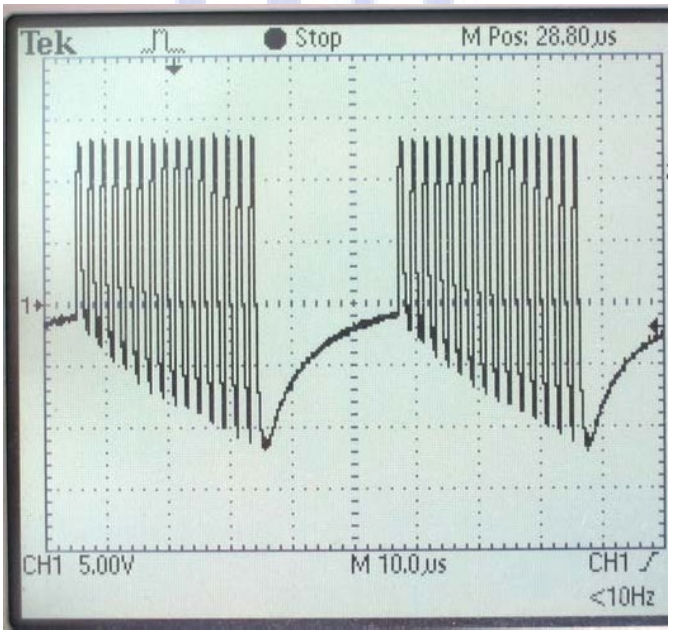


e. Perform the mode detection and observe the g-s waveform of power tube (P11NM60) with oscilloscope.

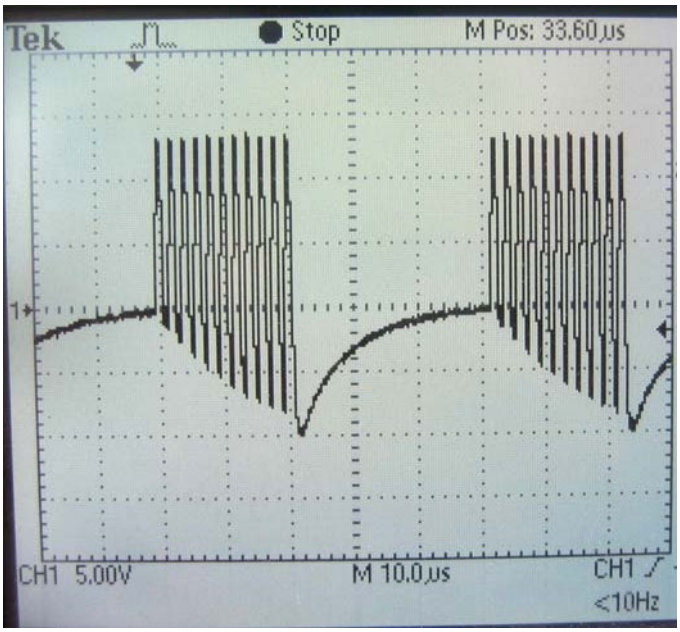
Observe the simple cutting, soft cutting, double pole cutting, doublepole typical coagulation and precise coagulation as indicated in the following diagram.



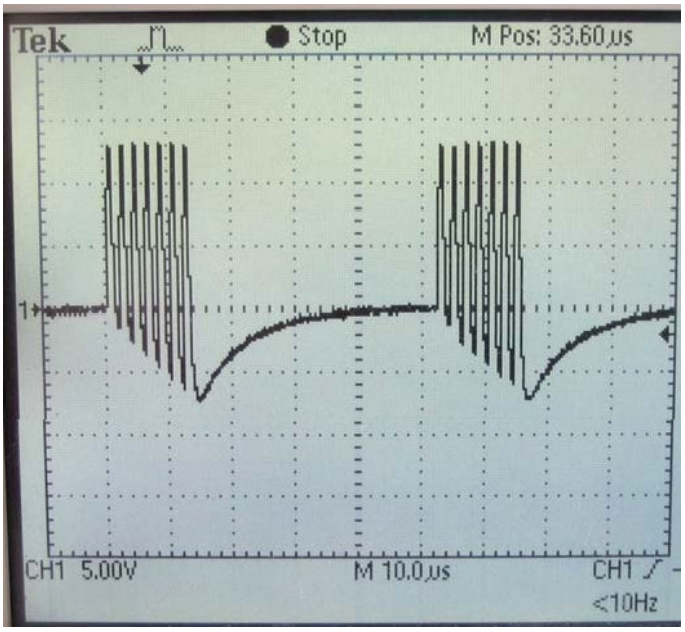
Waveform of mixed cutting 1 is as shown in the following figure:

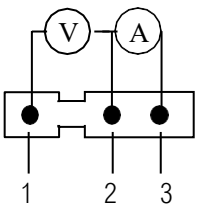


Waveform of mixed cutting 2 is shown as follows:



Waveform of mixed cutting 2 is shown as follows:





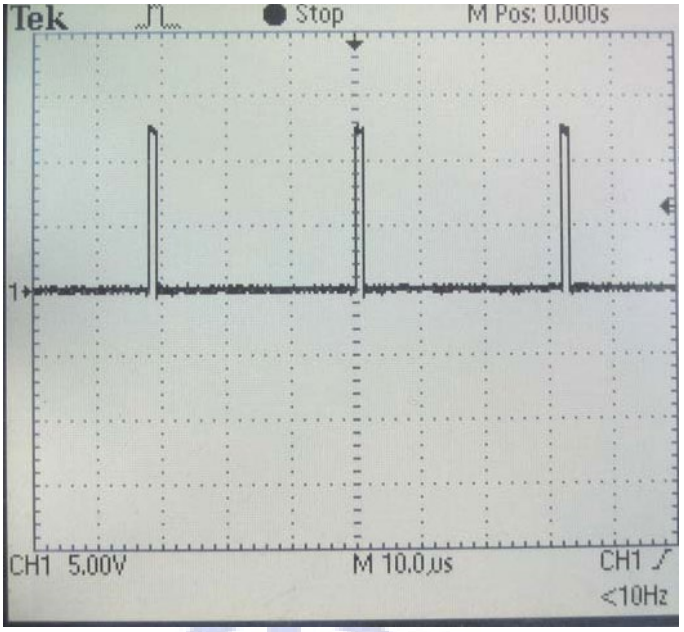
f. Connect the voltage and current monitoring meter with power supply panel J1005. (the measuring span of voltmeter shall be more than DC 200V, and that of the ammeter shall be more than DC 5A)

g. Switch on the machine to enter the debugging status with scalpel head and pole plate subjecting to no load. Once the simple cutting is initiated, the voltage value as displayed in the monitoring meter will increase with the increment of the AD value of PWM until it reaches 200V. The current value should not exceed 400mA.

3. Detection of Driving Signal from Single-tube Power Amplifying Circuit:

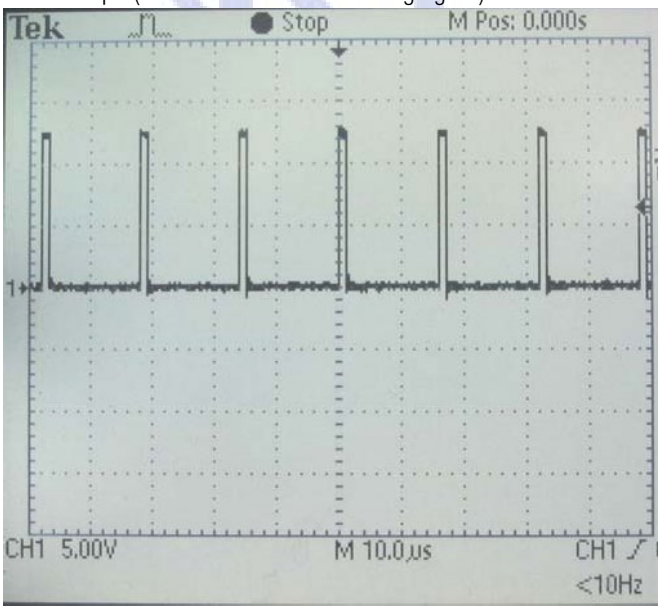
a. Pull out the short circuit plug of power supply panel J1005, and then switch on the machine to enter the debugging status for power setting.

b. Initiate the surface coagulation, observe the testing points TP2004 with oscilloscope and adjust the PR2008 so as to make sure that the pulse width is 1.2μs (as indicated in the following figure), and the cycle is 32μs.



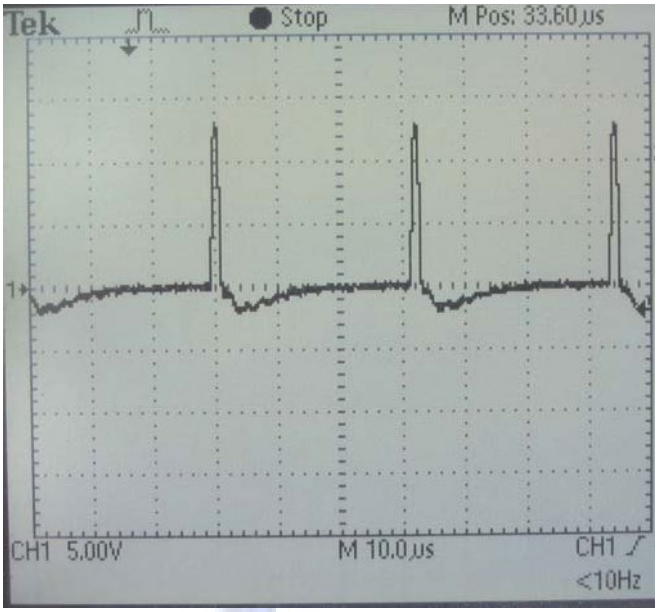
Waveform: Cycle is 32μs, and the pulse width is 1.2 μs.

c. Initiate the point coagulation and observe the testing point TP2004 with oscilloscope (as indicated in the following figure).

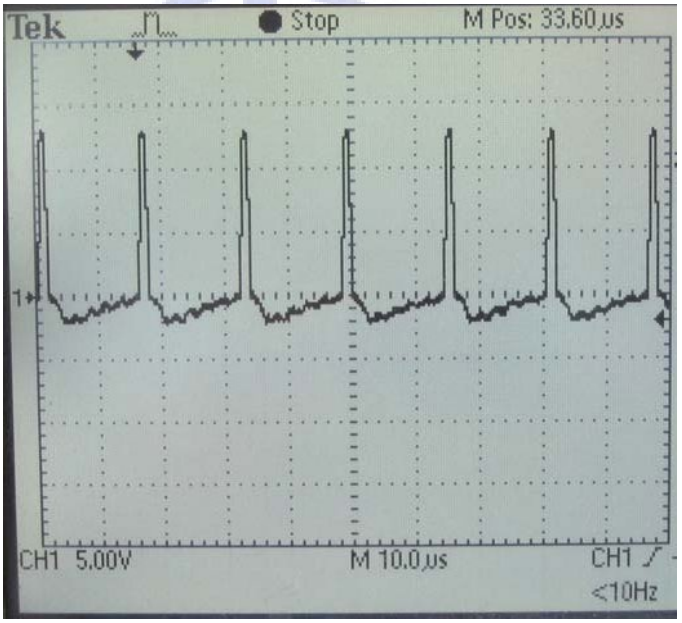


Waveform: Cycle is 16μs, and the pulse width is 1.2 μs.

d. Detect the driving waveform of VMOS tube, initiate the surface coagulation, observe the g-s waveform of the power tube (450) with oscilloscope and adjust the PR2009 so as to make the falling edge ofthe waveform straight and guard against any small pulse on the negative terminal. See the following figure.



e. Initiate the point coagulation and observe the g-s waveform of power tube as indicated in the following figure with oscilloscope.



f. Connect the voltage and current monitoring meter with power supply panel J1005 (same as that of the full bridge).

g. Switch on the machine to enter the debugging status with scalpel head and pole plate subjecting to no load. Once the simple cutting is initiated, the voltage value as displayed in the monitoring meter will increase with the increment of the AD value of PWM until it reaches 200V. The current value should not exceed 600mA.

Output Panel 1

Precise Operating Principle

The major function of output panel 1 is to produce an oscillation via NE555, which is used in turn to produce isolated initiation signal for manual control scalpel through the coil T5001, T5002 and self-restraint photo-coupler O5001-O5004.

Interface

J5001： Connected with power panel J2009 J5002：
Connected with power panel J2008 J5003： Connected
with J6011 of output panel 2J5004： Connected with
J6013 of output panel 2J5005： Connected with J6001
of output panel 2

Functional Detection

1. Insert the manual control scalpel into the OUT1, and then switch onthe machine to enter the operating status.
2. Initiate simple cutting and point coagulation respectively to activatethe relevant start-up indicator lamps.
3. Insert the manual control scalpel into the OUT2.
4. Initiate simple cutting and point coagulation respectively to activatethe relevant start-up indicator lamps.

Output Panel 2

Precise Operating Principle

The major function of output panel 2 is to make use of two independent resonant circuits to perform the full bridge and single tube power amplification so as to realize the uniform output via high voltage relay. The high voltage output part is equipped with current sampling circuit (T6006), high frequency creepage current sampling circuit (T6007), voltage sampling circuit (T6004), current sampling circuit (T6005) and pole plate resistance sampling circuit (T6003). All thesewill be transmitted to the power panel and the control panel for analysis.

Interface

J6001： Connected with J5005 of output panel 1 J6002，J6003：
Connected with the 60th ring of large-size coil J6006： Connected with
pole plate jack of the panel socket J6007，J6008： Connected with
nipper jack of the panel socketJ6009：Used to accept the foot control
scalpel
J6010： Connected with manual control scalpel 1 inserted into the panelsocket
J6011： Connected with J5003 of output panel 1
J6012： Connected with manual control scalpel inserted into the panelsocket
J6013： Connected with J5004 of output panel 1
J6014： Connected with pole plate switch of panel socketJ6015
： Connected with J2006 of power panel

Functional Detection

1. Insert the manual control scalpel into OUT1, and then switch on themachine to enter the operating status.
2. Initiate the simple cutting and point coagulation respectively toactivate power output.
3. Insert the manual control scalpel into the OUT2.

4. Initiate the simple cutting and point coagulation respectively toactivate power output.
5. Insert the nipper and initiate the double pole cutting to activate thepower output.

Back Panel

Precise Operating Principle

The major function of the back panel is to produce an oscillation via NE555 as well as isolated foot control scalpel start-up signal via coil T7002 and self-restraint photo-coupler O7002 and O7003. The back panel is also equipped with a LM386 vocalizing circuit.

Interface

J7003： Connected with J2004 of power panel J7004：
Connected with foot switch fixed to the shell

Functional Detection

Switch on the machine to enter the operating status, and initiate the simple cutting and point coagulation concurrently with foot switch without imposing the power. At this point, the indicator lamp will flash accompanied by different start-up voice.

Debugging of Integral Pole

This part includes the following four sections:

- Power Setting
- Regulation of Short Circuit Current
- Regulation of High Frequency Creepage Current
- Detection of Affixing Area

,

Power Setting

1. Switch on the machine to enter the debugging status.
2. Press the double pole precise coagulation mode selector key or double pole typical coagulation mode selector key to select the appropriate mode. At this point, the indicator lamp for the selected modeshall flash. If the mode indicator lamp does not flash, it means that the machine is in double pole cutting mode. See the following figure.

3. At this point, the single pole cutting power set value display windowwill display by turns the set mode positioning point as well as the currentor power value to be set.

See the following figure:

Press the simple cutting mode selector key to make switch between required current value and power value. The displayed value at thedefault start-up status is the current value.

See the following figure:

The single pole cutting power set value display window aims to displaythe positioning point of the set mode. See the following figure:

N-M

N： N refers to set mode (1-A).

1：Simple Cutting；2：Mixed Cutting 1；3：Mixed cutting 2；4：Mixed Cutting 3；5：Soft Coagulation；

6：Point coagulation；7：Surface Coagulation 8：Double Pole Cutting；9：Precise Double Pole Coagulation；

A：Typical Double Pole CoagulationM：

Set Point (0-9)

4. Once the set mode is selected, the output will be switched into conduction with rated load. Except for the precise double pole coagulation, of which, the rated load is 200Ω, the rated load in other modes should be up to 500Ω.

5. The initial point in each mode is the zero point. At this point, the power value to be set as well as the AD value of PWM as displayed in single pole coagulation power set value display window is also zero.

See the following figure:

6. Initiate this mode until the displayed AD value of PWM flashes for 3times, and then press the soft coagulation mode selector key (power setting key) to set the value at zero point.

7. Change the displayed value of set mode position point to 1 or the N-1. At this point, the set power value will also be changed to the set value of 1 automatically.

8. Press the single pole coagulation power setting increment/decrement key (increment/decrement key used to adjust the Ad value of PWM) to adjust the AD value of PWM so as to make sure that the output power is the same as that at the point 1.

See the following figure:

9. Initiate this mode until the displayed AD value of PWM flashes for 3times, and then press the soft coagulation mode selector key (power setting key) to set the value at 1 point.

10. Set in turn all the other power points (0-9).

11. In case of error of set power point, it is applicable to press the single pole cutting power setting increment key or decrement key to reset it.

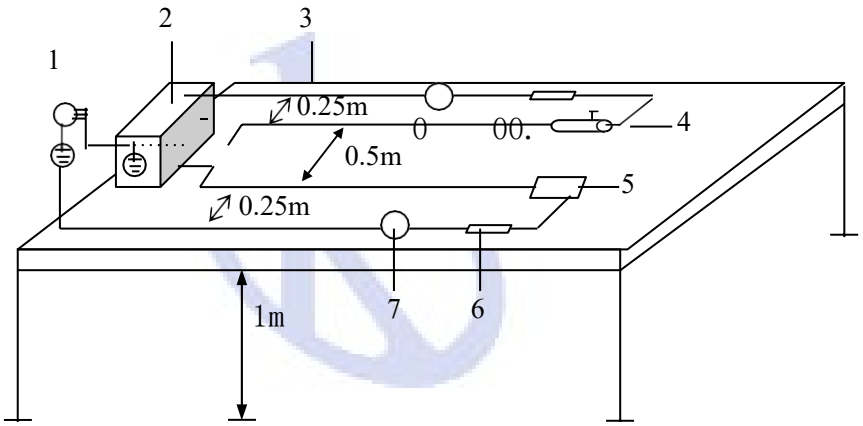
12. After all the 9 power points in this mode are set, select the next mode for setting.

Regulation of Short Circuit Current

1. YR02144 aims to control the short circuit of hardware used for single pole cutting and coagulation. At the same time, the software can also be used to control the short circuit.
2. In normal operation, the software is frequently used to control the short circuit, and the hardware only plays a role of protection.
3. Switch on the machine to enter the operating status, and impose a load of 100Ωon the scalpel head and pole plate.
4. Initiate the maximum power for simple cutting, and adjust the potentiometer PR2002 on the power panel so as to limit the current.After that, slowly release the potentiometer until it is not unable tocontrol the current.
5. Initiate the maximum power for mixed cutting 1, and adjust the potentiometer PR2006 on the power panel so as to limit the current.After that, slowly release the potentiometer until it is not unable tocontrol the current.

Regulation of High Frequency Creepage Current

1. Put the machine to be tested on the high frequency creepage current testing stand, and then lead the power supply to the 253V voltage regulator. Connection should be performed in line with thefollowing figure:



1-Power Network 2-High Frequency Electric Scalpel 3- Table made ofinsulating materials 4-Surgery Electrode

5- Neutral Electrode 6-200ΩMeasuring Electric Resistance 7-HighFrequency Ammeter

2. Power should be set at the maximum value in each mode.
3. Adjust each potentiometer on the power panel in each mode so as tomake sure that the high frequency creepage current is less than 150mA.
   Simple Cutting: PR2003 Mixed
   Cutting: PR2004 Surface
   Coagulation: PR2005Point
   coagulation: PR2007

Detection of Affixing Area

1. Test the pole plate socket on the machine panel and install the resistance box.
2. Switch on the machine to enter the operating status.
3. Set the pole plate resistance at 120 Ω, adjust the potentiometer PR1 on the regulating control panel so as to keep the machine from giving alarm. At this point, the 2 bars of affixing area indicator flash.
4. Reset the resistance at 121Ω so as to make the machine give alarm and 1bar of the optical strip flash.
5. When the set resistance between pole plates is 9Ω, the machine should give alarm. Otherwise, it is necessary to adjust the potentiometer PR2 on the regulating control panel to make the machine give alarm.
6. When the resistance between pole plates is 10Ω, the machine shouldnot give alarm. Otherwise, it is also necessary to adjust the PR2 to keep the machine from giving alarm.
7. Adjust the potentiometer PR1 again to make the machine give alarmwhen the resistance is set at 121 Ω instead of 120 Ω.
8. Repeat the procedure 2, 3 and 4 until the machine does not give alarm when the resistance is set between 10-120 Ω other than other resistance values.
9. Perform verification in line with the following table:

Pole Plate Mode	Status	Requirement
Single –plate Mode	Pole plate not inserted	Bar lights but alarm lamp extinguish
	Insert pole plate	No alarm, all the bar lights extinguish
Double –plate Mode (to be connected with resistance box))	0-9Ω	Alarm, all the bar lights flash
	10Ω	No alarm, all the bar lights flash
	125Ω	No alarm, 2 bars of bar lights flash
	>125Ω	Alarm, 1 bar of bar lights flash or all the bar lights extinguish
	Set the resistance level of resistance box at 20Ω, initiate the simple cutting and then set the resistance level of resistance box at 27Ω±1Ω.	Alarm

Fault List

This part includes the following two sections:

- Precise Fault List
- Fault Code Table

Precise Fault List

Fault	Fault analysis	Cause
Display panel nixie light and indicator lamp do not flash	Power switch indicator lamp does notflash, main power source fault	Check whether the main power supply is available, whether the fuse is burnt or whether the power switch is normal.
	Power switch indicator lamp flashes. No 5V and ±12V voltage output from power module	Power module is damaged.
	There is 5V and ±12V voltage outputfrom power module	panel or display panel line fault
Unable to initiate the machine	Check the accessories (manual control scalpel or foot switch)	Relevant accessories are damaged.
	There is start-up voice	Display panel line fault
	The manual control initiation but thefoot control initiation is available	Back panel line fault
	The foot control initiation but themanual control initiation is available	Output panel 1 line fault
	Both manual and foot controlled initiation are not available.	CPU panel line fault
No voice	No square wave on the R7007 of theback panel	CPU panel line fault
	Waveform can be detected on thetrumpet.	Back panel line fault
	Waveform can not be detected on the trumpet.	The trumpet is damaged
The selected pole plate mode is not in conformity with pole plate indicator lamp.	Check the pole plate socket fixed to the exterior shell.	The switching relay fixed to the socket of the pole plate is damaged.
	No switching signal	CPU pole plate line fault
When the single pole plate is used, the machine gives alarm.	Check accessories	Pole plate line is open circuit
	Check whether the affixing area transducer has been firmly installed.	Whether the installation of output panel T6003 is firm.
	Detect the internal fault of the machine	CPU Panel line fault
The affixing area indicator lamp flashes and the machine gives alarm even though the double pole plate has not been affixed to the patient's body	Check the wiring of soft pole plate.	The connecting line of soft pole plate is in short circuit or the holding seat has not been fixed yet.
	If it is still the case when the poleplate plug is pulled out.	CPU Panel line fault
When the affixing area is affixed to the patient's body, the	Check the wiring of soft pole plate.	The connecting line of soft poleplate is in open circuit or the holding seat is poor in contact.

affixing area indicator lamp extinguish and the machine give alarm.	Internal fault of the machine	CPU Panel line fault
When the affixing area is affixed to the patient's body, the affixing area indicator will displaythe obvious increment or decrement of affixing area.	Deviation of detected value	Readjust the affixing area parameter.
No power output	Check accessories (manual control scalpel, foot control scalpel, nipper or connecting line)	Relevant accessories are damaged
	Check the amplifying power	See Part 5-Power Supply Panel
	Check the driving waveform	See Part 5-Power Panel
	Check the resonant circuit of output panel.	See Part 5-Output Panel 2

Fault Code Table

The fault codes are displayed respectively in double pole coagulation power setting display window, single pole cutting power setting display window and singlepole coagulation display window. Detail forms are shown as follows:

Double Pole coagulation Power Setting Display window	Single Pole Power Setting Display window	Single Pole Coagulation Power Setting Display Window
Er	××× Fault Category	××× Fault Number

Fault code			Fault Category	Fault Implication
Er	Cur	000	Cur Error marking of curve	AD value of power at the current point is not higher than thepreceding one
Er	Cur	001		Extraordinarily high power curve offsetting value
Er	Cur	002		AD value of voltage at the current point is not higher than thepreceding one
Er	Cur	003		AD value of current at the current point is not higher than thepreceding one
Er	Cur	004		PWM value at the current point is not higher than the precedingone
Er	Cur	005		The PWM feedback to the CPU for reservation is differentfrom that of the main CPU.
Er	Cur	006		The P feedback to the CPU for reservation is different from thatof the main CPU.
Er	Cur	007		The V feedback to the CPU for reservation is different fromthat of the main CPU.
Er	Cur	008		The I feedback to the CPU for reservation is different from thatof the main CPU.
Er	Cur	009		The VWS feedback to the CPU for reservation is different fromthat of the main CPU.
Er	Cur	00A		The AD value of power at the current point feedback to theCPU is not higher than that of the preceding one.
Er	Cur	00B		The AD value of voltage at the current point feedback to theCPU is not higher than that of the preceding one.
Er	Cur	00C		The AD value of current at the current point feedback to theCPU is not higher than that of the preceding one.
Er	Cur	00D		The AD value of independent voltage transducer curve at thecurrent point is not higher than that of the preceding point.
Er	Cur	00E		The AD value of independent current transducer curve at thecurrent point is not higher than that of the preceding point.
Er	Cur	00F		The AD value of independent power transducer curve at thecurrent point is not higher than that of the preceding point.

Fault code			Fault Category	Fault Implication
Er	CAL	100	CAL Error in measurement and computation	Non-conformance curve and power mode saved in the RAM
Er	CAL	101		Extraordinarily high power curve offsetting value
Er	CAL	102		AD value is higher than 0x3FF PWM
Er	CAL	103		value is higher than 0x3FFError AD
Er	CAL	104		value of PWM
Er	CAL	105		Analog 12VPower Error
Er	USr	200	Usr Error in keyboard operation	No single pole cutting mode mark No
Er	USr	201		double pole cutting mode mark
Er	USr	202		No single pole coagulation mode mark No
Er	USr	203		double pole coagulation mode mark
Er	USr	204		No foot control output/double pole mode indicator lamp markNo plus
Er	USr	205		and minus key code
Er	EEP	300	EEP EEPROM read-write error	No acknowledge signal
Er	EEP	301		Read-in is not available
Er	COF	400	COF Error of communication between main CPU and feedback CPU	The number of data transmitted exceeds the maximum numberspecified Failure to receive error message within 500msData
Er	COF	401		verification error
Er	COF	402		The number of character strings received is incorrect.
Er	COF	403		Incorrect prefix and postfix of data string
Er	COF	404		Error in CRC verification of character string
Er	COF	405		“#esc5\n” is received, communication failure
Er	COF	406		“#esc5\n” is received, communication failure, error in CRC
Er	COF	407		verification by the receiver
Er	COF	408		“#esc5\n” is received, error in parity check by the receiver, communication failure
Er	COF	409		Incorrect contents of replied order
Er	COF	40A		Incorrect data contents replied

Fault code			Fault Category	Fault Implication
Er	INt	500	INt Interruption error	Error in selection of AD channel number
Er	INt	501		Error in selection of channel number during the AD switching-over
Er	FPU	600	FPU 60× Incorrect marking of curve lineby feedback CPU	AD value of power at the current point is not higher than the preceding one
Er	FPU	601		Extraordinarily high power curve offsetting value
Er	FPU	602		AD value of voltage at the current point is not higher than the preceding one
Er	FPU	603		AD value of current at the current point is not higher than the preceding one
Er	FPU	604		PWM value at the current point is not higher than the preceding one
Er	FPU	610	FPU 61× Error in measurement and computation	Non-conformance curve and power mode saved in the RAM
Er	FPU	611		Extraordinarily high power curve offsetting value
Er	FPU	612		AD value is higher than 0x3FF
Er	FPU	613		PWM value is higher than 0x3FF
Er	FPU	614		Incorrect backup of important data
Er	FPU	620	FPU 62× Error in keyboard operation	No single pole cutting mode mark
Er	FPU	621		No double pole cutting mode mark
Er	FPU	622		No single pole coagulation mode mark
Er	FPU	623		No double pole coagulation mode mark
Er	FPU	624		No foot control output/double pole mode indicator lamp mark
Er	FPU	625		No plus and minus key code
Er	FPU	630	FPU 63× EEPROM read-write error	No acknowledge signal
Er	FPU	631		Read-in is not available
Er	FPU	640	FPU 64× Error communication with feedback CPU	The number of data transmitted exceeds the maximum numberspecified
Er	FPU	641		Failure to receive error message within 300ms
Er	FPU	642		Data verification error
Er	FPU	643		The number of character strings received is incorrect.

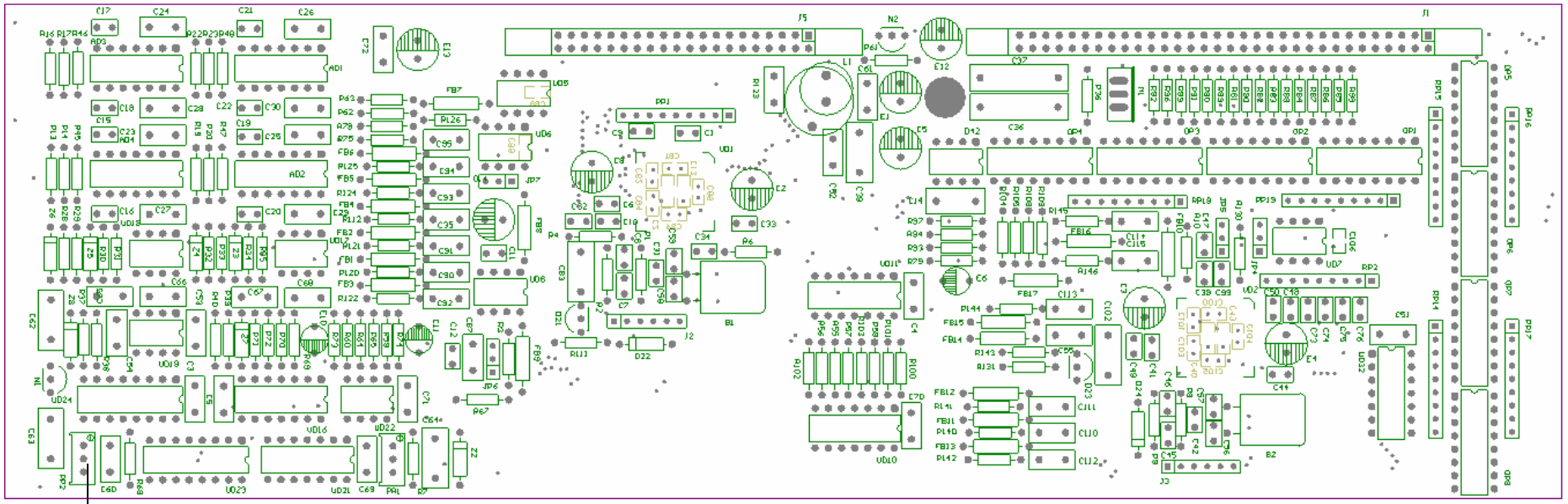
Fault code			Fault Category	Fault Implication
Er	FPU	644		Incorrect prefix and postfix of data string
Er	FPU	645		"#esc5\n" is received, communication failure
Er	FPU	646		Incorrect contents of replied order
Er	FPU	647		Incorrect data contents replied
Er	FPU	650	FPU 65×	Error in selection of AD channel number
Er	FPU	651	Interruption error	Error in selection of channel number during the AD switching-over
Er	FPU	660	FPU 66×	Invalid current limitation
Er	FPU	661	Control and detection error	Invalid power limitation
Er	FPU	662		Invalid termination of power current
Er	FPU	663		Invalid termination of power
Er	FPU	664		power mode error
Er	FPU	665		Single pole/double pole relay feedback input error
Er	FPU	666		Single pole/double pole relay feedback input error
Er	FPU	667		Power cutting/coagulation relay feedback input error
Er	FPU	668		Power cutting/coagulation relay feedback input error
Er	FPU	669		Power output channel 1 relay feedback input error
Er	FPU	66A		Power output channel 2 relay feedback input error
Er	FPU	66B		Power output relay feedback input error
Er	FPU	66C		Incorrect AD value of Vref/2
Er	FPU	66D		Analog 12Vpower error
Er	FPU	700	CCd Error in initiation of power	Irrelevant power is outputted.
Er	FPU	701		Tim-out in terminating power output of feedback CPU
Er	FPU	702		Feedback CPU fails to output the output relay control signal error in time.

Fault code			Fault Category	Fault Implication
Er	FPU	703		Feedback CPU fails to output the power mode error in time.Feedback CPU
Er	FPU	704		fails to output the PWM error in time.
Er	FPU	705		Feedback CPU fails to terminate the output power error in time.
Er	tAG	800	tAG Error in loading and saving the operating parameter array	The current operating parameters are not in conformity with thestructural variable of operating parameter array.
Er	tAG	801		Invalid data showing the structural variable of operating parameter array
Er	UnE	900	UnE Error in integrating the main/feedback CPU software with hardware	Inconsistent software version No.WDT
Er	UnE	901		error
Er	UnE	902		In consistent AD switching value of 5V/2 channel of main/feedback CPU
Er	UnE	903		In consistent AD switching value of 12V/4 channel of main/feedback CPU
Er	UnE	904		In consistent AD switching value of voltage channel of main/feedback CPU
Er	UnE	905		In consistent AD switching value of current channel of main/feedback CPU
Er	UnE	906		In consistent AD switching value of power channel of main/feedback CPU
Er	UnE	907		In consistent AD switching value of mode channel of main/feedback CPU
Er	UnE	908		In consistent AD switching value of pole plate resistancechannel of main/feedback CPU
Er	UnE	909		Inconsistent PWM value of main/feedback CPU

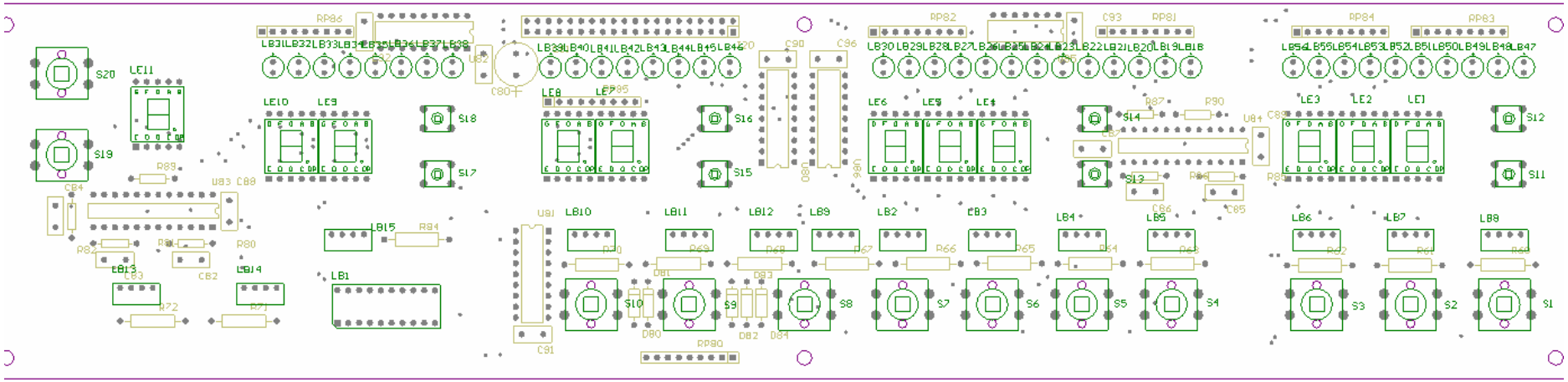
Appendix

- Diagram for Control Panel
- Diagram for Display Panel
- Diagram for Power Supply Panel
- Diagram for Power Panel
- Diagram for Output Panel 1
- Diagram for Output Panel 2
- Diagram for Back Panel

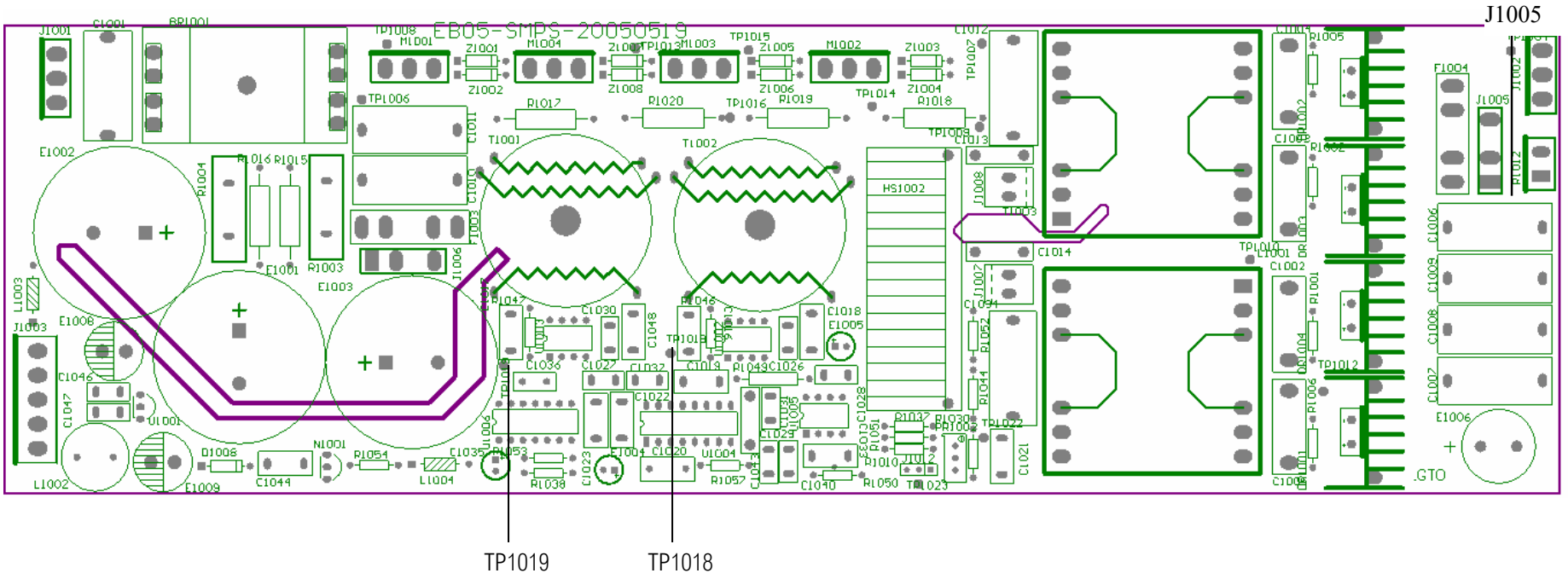
Control Panel



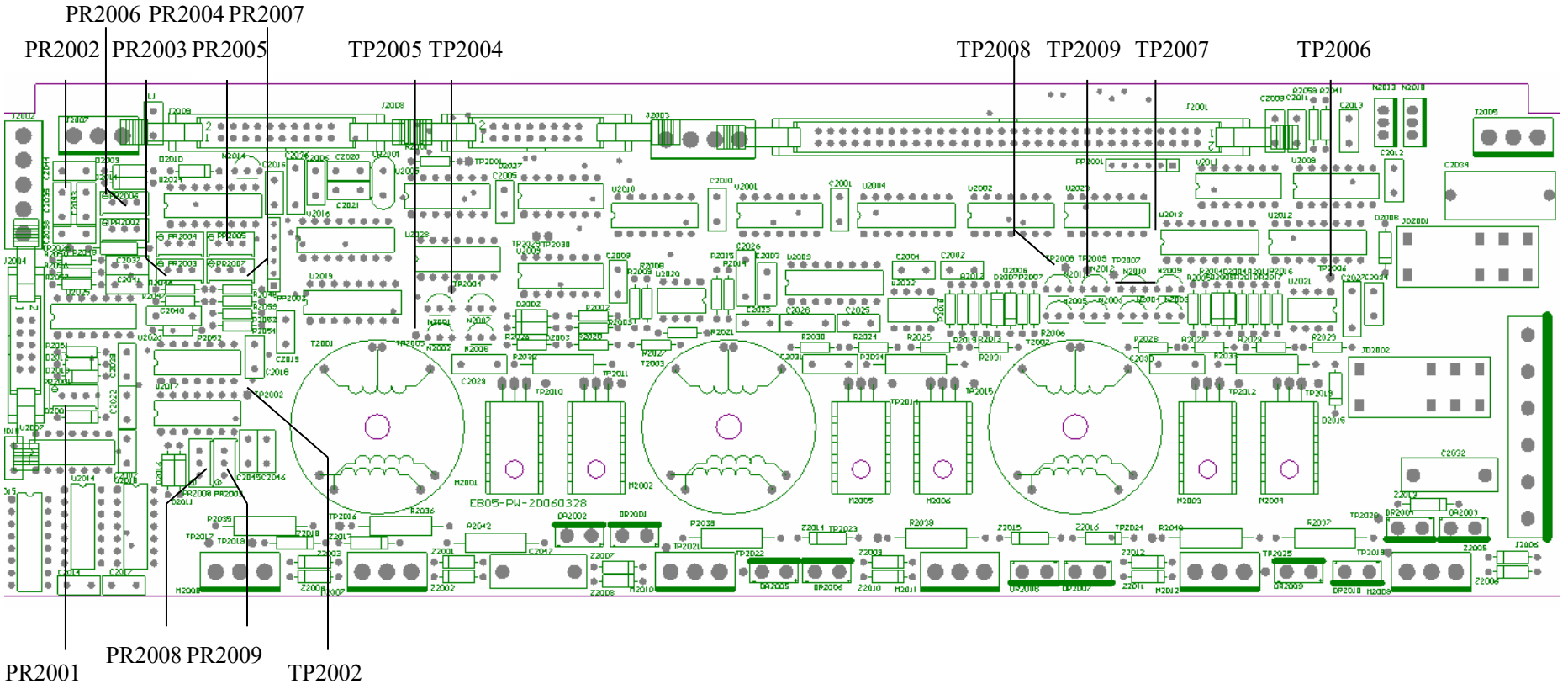
Display Panel



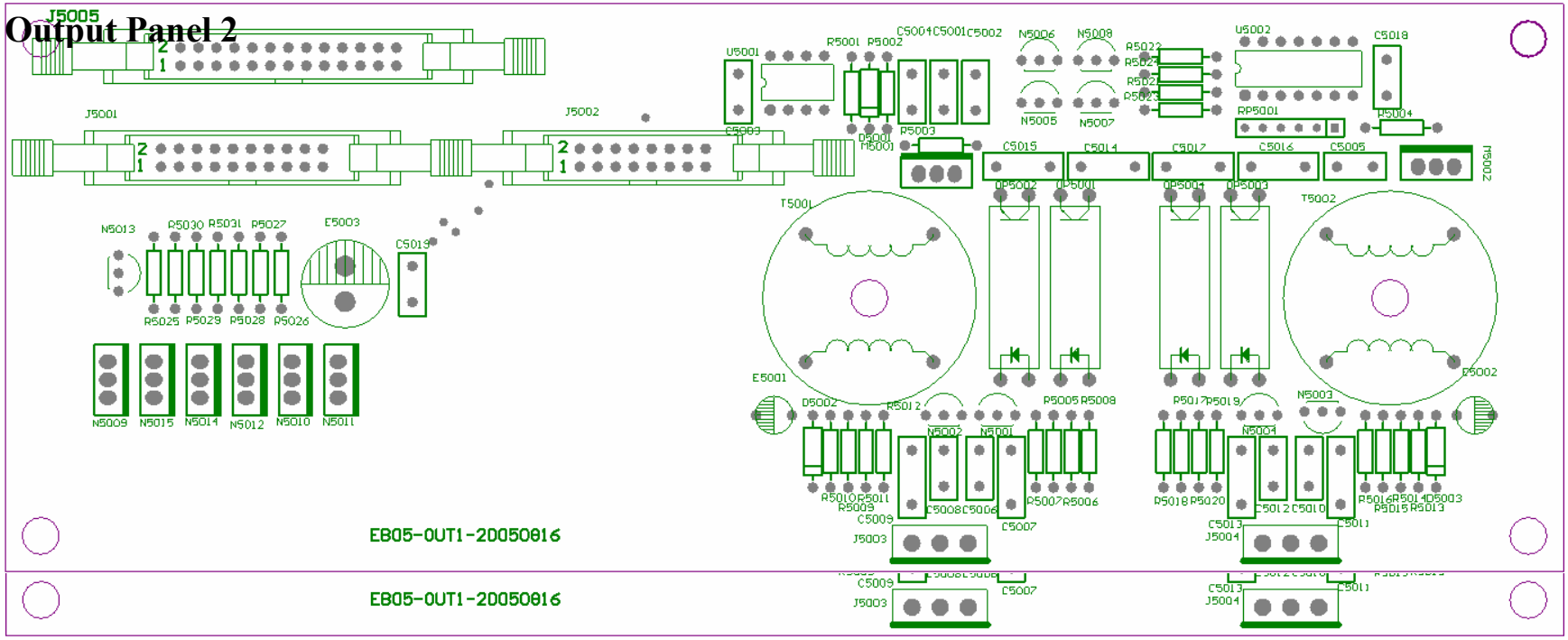
Power Supply Panel



Power Panel

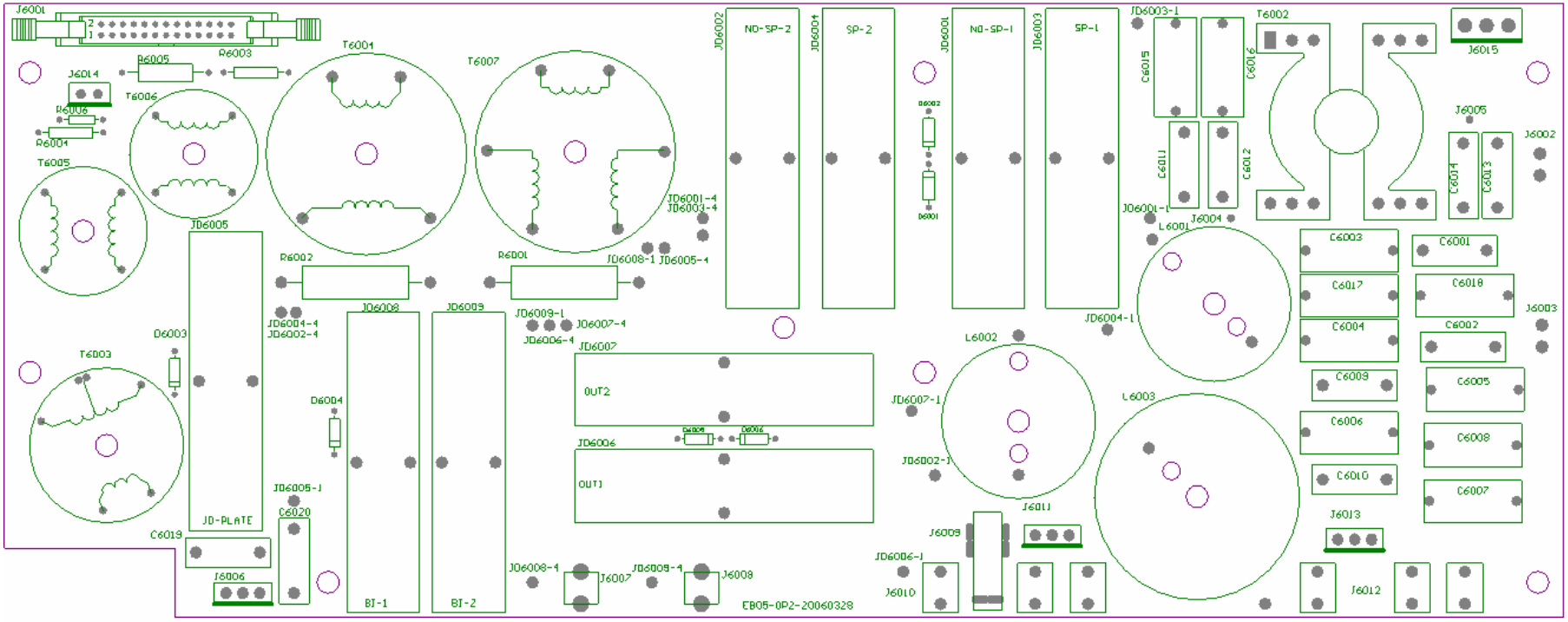

PR2006
PR2004
PR2007
PR2002
PR2003
PR2005
TP2005
TP2004
TP2008
TP2009
TP2007
TP2006
PR2001
PR2008
PR2009
TP2002
EB05-PW-20060328

Output Panel 1

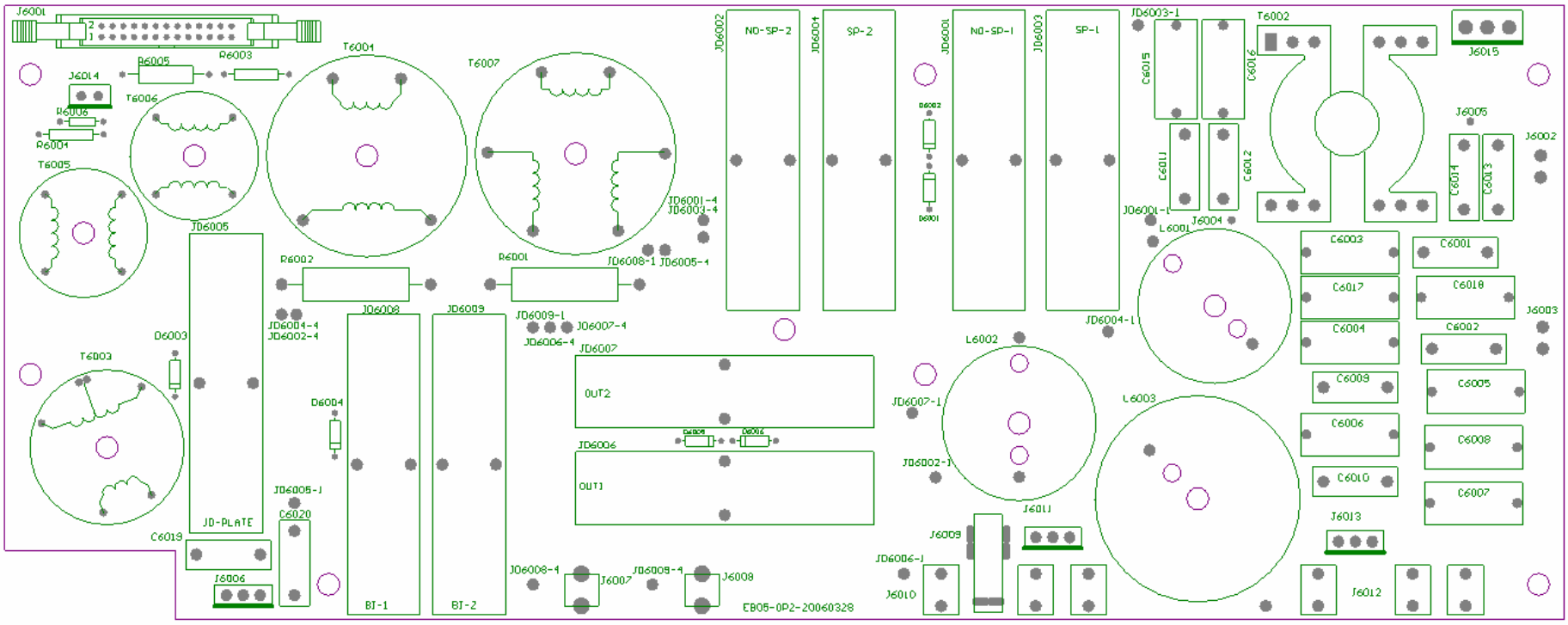


Output Panel 2

Output Panel 2



Back Panel


J6001
R6005
R6003
T6004
T6007
J6014
T6006
R6006
R6004
T6005
JD6005
R6002
R6001
JD6008
JD6009
D6003
T6003
D6004
JD-PLATE
C6019
C6020
J6006
BI-1
BI-2
OUT2
OUT1
JD6007
JD6006
J6007
J6008
EB05-0P2-20060328
JD6002
NO-SP-2
JD6004
SP-2
JD6001
NO-SP-1
JD6003
SP-1
JD6003-1
T6002
J6015
C6015
C6016
C6011
C6012
J6005
J6002
C6014
C6013
JD6001-1
L6001
J6004
JD6004-1
C6003
C6001
C6017
C6018
C6004
C6002
C6009
C6005
C6006
C6008
C6010
C6007
L6002
JD6007-1
JD6002-1
L6003
J6011
J6009
JD6006-1
J6010
J6013
J6012

YR02144 Service parts List

NO.	Part Number	Name	PCS
1	7PB-YR02144DS-002	Display board	1
2	7PB-YR02144CB-002	Control board	1
3	7PB-YR02144PW-001	Power board	1
4	7PB-YR02144OP1-001	Output board 1	1
5	7PB-YR02144OP2-001	Output board 2	1
6	7PB-YR02144DY-002	Power supply board	1
7	7PB-YR02144HM-002	Back Panel board	1
8	7DY-MPS3012-001	12V Power Module （MPS-30-12）	1
9	7DY-MPT45B-001	5V ±12VPower Module （MPT-45B）	1
10	1VM-840-001	VMOS 840	4
11	1VM-W12NK9-001	VMOS W12NK90Z	2
12	1VM-P11NK6-001	VMOS P11NK60	4
13	1DP-R311-001	Fuse seat R311,250VAC,10A	2
14	1FS-T6.3A250-001	FUSE 6.3A	4
15	1DP-10A250-001	Power jack	1
16	1AS-PAGM04-001	Petal switch seat	1
17	YR02144-36	Radiator A	1
18	YR02144-37	Radiator B	1
19	1RX-471100-001	Power Resistor	1
20	2JT-D3H3，74-001	Insulating screw casing	10
21	6GY-015012-001	Insulating gaskets	8
22	6GY-026020-001	Big Insulating gaskets	2
23	7HT-00T1-001	Power coil	1
24	1WC-10A110-SW1	Power line	1
25	1SW-RF1004-G01	Main power switch	1
26	1LT-FN2060-1006	Filter	1