

# **3 Wavelength Laser Hair Removal** **Machine**

**Model #: FG 2000-B**

**User manual**



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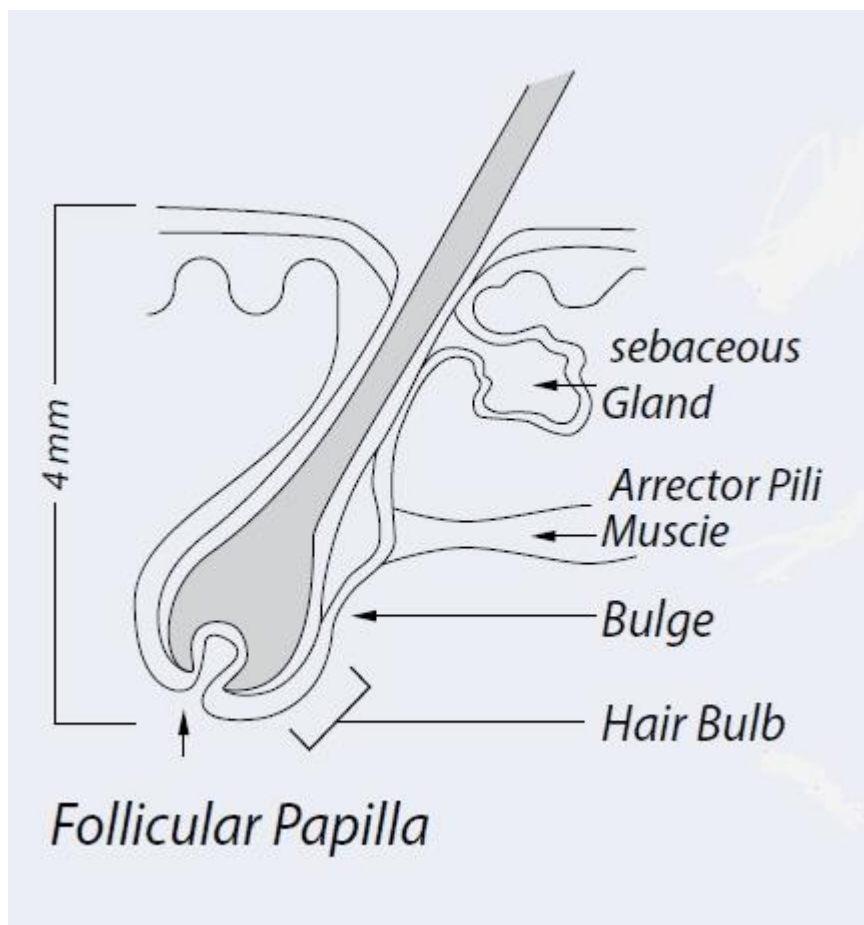
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## Preface

Welcome to use the 808nm&1064nm&755nm 3 wavelength Laser Hair Removal Instrument produced by our company. 3 wavelength Laser Hair Removal Instrument is the high-tech product that is independently developed by our company and with independent intellectual property right.

This manual is applicable to the standard 3 wavelength Laser Hair Removal Instrument.

First make a check to the accessories according to packaging labels, if the accessories delivered with the instrument are incomplete, contact us immediately.



**Warnings to users:** 

If it is the first time for you to use Diode Laser Hair Removal Instrument, be sure to carefully read this

manual before powering on the appliance.

It is suggested that do not use the hair removal instrument with the existence of electromagnetic interference, vibration and other environmental conditions with interference. During operation, the instrument does not interfere other equipments/devices

Avoid using this Diode Laser Hair Removal Instrument when there are the flammable anesthetics or oxidative gases such as nitrous oxide (N<sub>2</sub>O) and oxygen. When there is enough oxygen in the air, some materials, for example, the cotton and wool materials may easily be ignited by the high temperature resulting from the normal operation of laser equipment. The solvent and combustible solution for cleaning or sterilization purpose shall be volatilized before using laser equipment.

The abandoned components from the scrapping or replacement of Diode Laser Hair Removal Instrument should be delivered to the designated agency or manufacturer for joint treatment, so as to avoid environmental pollution.

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# Chapter 1: Introduction

## I. Theory

The system uses the optimal hair removal wavelength of 810nm diode for deep penetration into the dermis where the hair follicle is located.

In treatment procedure, a series of low fluence, high repetition pulses increases the temperature of both the hair follicle and the surrounding, nourishing tissue to 45 degree Celsius. This more gradual heat delivery uses the chromophores into the surround tissue as reservoirs to effectively heat up the hair follicle. This, along with the heat energy absorbed directly by the hair follicle, damages the follicle and prevents re-growth.

## II. Application

**Permanent hair removal for men and women, areas like face, arms, armpits, chest, back, bikini, legs...**

## III. Specification

Laser type	Diode laser
Laser wavelength	755nm,808 nm,1064nm
Display	8.4" color touch LCD screen
Output power	1000W
Treatment laser spot	12 × 12 mm <sup>2</sup>
Pulse width	8~685ms (continuously adjustable)

Energy density	2 ~120J/cm <sup>2</sup> (continuously adjustable)
Temperature of probe	0~3 <sup>0</sup> C
Pulse frequency	0.5~10Hz
Cooling mode	Water + air + semiconductor
Dimension of device	42*63*54cm
Dimension of package	66*66*73cm
Net weight	30 kg
Gross weight	52kg
Voltage	AC 220/50Hz ; AC 110/60Hz
Packing	Aluminum alloy case

## IV. Taboos

- ◆ Pregnant women
- ◆ Insulation in the sun
- ◆ be hypersensitive to light or medicine, or are taking medicine that sensitive to light
- ◆ Using vitamin within 6 months
- ◆ Not representative naevi or malignant pathological changes in the treatment area.
- ◆ Pacemaker or quiver dispelling machine user

- ◆ Herpes or trauma
- ◆ Pimple record
- ◆ People who accept Hirudin etc. treatment (should stop using it before 2 weeks).
- ◆ Serious diabetes patient, high blood pressure sufferer, and epileptic



# Chapter 2: Safety Precautions

## I. Security Introduction

Those who have been trained can use this system. No matter the operator, the assistant, or the maintainer need to understand this chapter well. However, people's safety is most important; it has been taken into consideration during the design process.

- a) When the device is turned on, the auto-inspection safety system is also initiated and keep working through whole treatment process.
- b) Independent safety circuit design can cut off the power supply while electric leakage happens
- c) Red "Emergency" button can cut off the power supply immediately in emergency situation.

### **【WARNING】**

Please read following notice carefully for safe operation.

- a) Except the authorized mechanic, any others have no right to examine and repair the system, especially the inside components including electrical source, cooling system, optic organs and treatment head.
- b) Make sure the voltage is accordant to your resident voltage
- c) Maintenance must be done after turning off the machine and unplug the power cord. Or there is risk to injure people or damage the equipment.
- d) Stop turning on machine when finding slack on treatment head. If the machine is ON, turn off right now.



## Warning

Diode laser hair removal machine can emit high-intensity infrared laser beam, in order to protect the eyes, the users and patients are requested to wear appropriate safety goggles in accordance with (NOHD) standard.

Pay attention to the following precautions:

- ※DO NOT point the laser directly to the eyes and skin.
- ※DO NOT cut off power supply when the machine is working.
- ※Be sure to get familiar with structures and specifications of the machine before using.

## II. Electrical and mechanical safety

- a) Keep all panels and covers closed, or there may be danger.
- b) There is high pressure inside the equipment. It's possible to deposit electricity in some parts even after switching off. So it's not allowed to open equipment except the authorized mechanics.
- c) When do maintenance, please unplug power, cover board, and observe in person.

- d) Moving the machine incorrectly may cause personal injury. The machine is well balanced and is movable, but only move slowly and carefully.
- e) The machine via three-wire power cord grounding the earth, good ground is essential for safe operation.

## 【PREVENT FIRE】

- a) The temperature will raise after absorbing light energy, so please take actions to reduce the flammable risk on treatment parts or around area.
- b) Do not use ethanol, acetone or other flammable things on skin before treatment. If necessary, please use soap or water.
- c) When listerizing the treatment head or other parts with alcohol, please wait till dry.

## 【SAFETY SETTINGS】

There are some safety settings with equipment, so please know their places and using methods.

- a) **Keys:** it's used to switch ON/OFF the power, only provided by the manufacturer.
- b) **Emergency button:** the red switch is used to switch off power on emergency. Press it can switch off the power immediately. Turn it clockwise, the machine will be go on working. Or the machine keeps turning off.

## 【AUTOMATICAL INSPECTION】

After turning on the machine, the system will do an automatic inspection. About 1-3 minutes running automatically, then it enters into the next step.

## **【CLASS OF EQUIPMENT】**

- a) Class: II b
- b) Anti-corrosive liquid: general
- c) Not allowed to use in the air mixed flammable anesthetic and nitrous oxide
- d) Operation manner: continuous operation

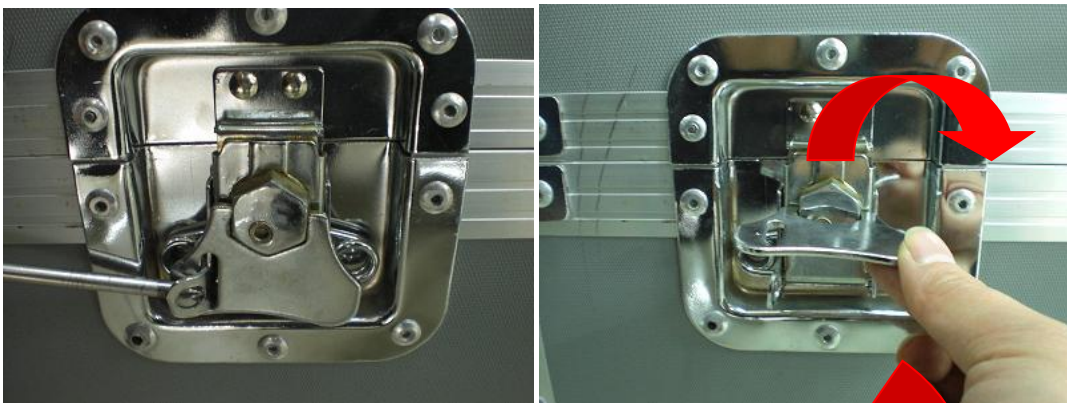
# Chapter 3: installment

## I. Packing box

The package when you received is same as shown in the photo. If any damages happened during transportation, please contact us or carrier immediately!








*How to open the box?*









## II. Accessories

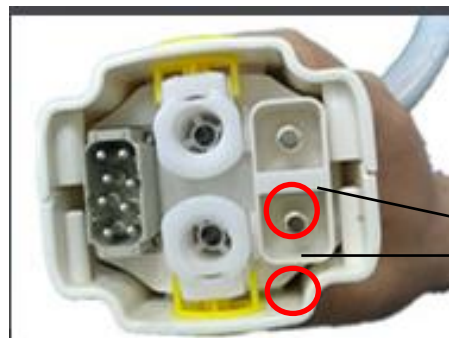
The following are the main unit and accessories of Diode Laser Hair Removal Instrument:

c	Name	Photo	Qty.
1	Handpiece & holder		1 set
2	Foot switch (IPX1)		1 pc
3	Safety eyepatch for patient		1 pair
4	Safety goggles for operator		1 pair
5	Water filter core		2 pcs

6	Power cord			1 pc
7	Water funnel & pipe			1 set
8	Water connector			2 pcs
9	Short circuit clip			1pc

Please check up whether the accessories are complete, if the accessories have lost in transportation, please contact us immediately. We will offer help at the first time.

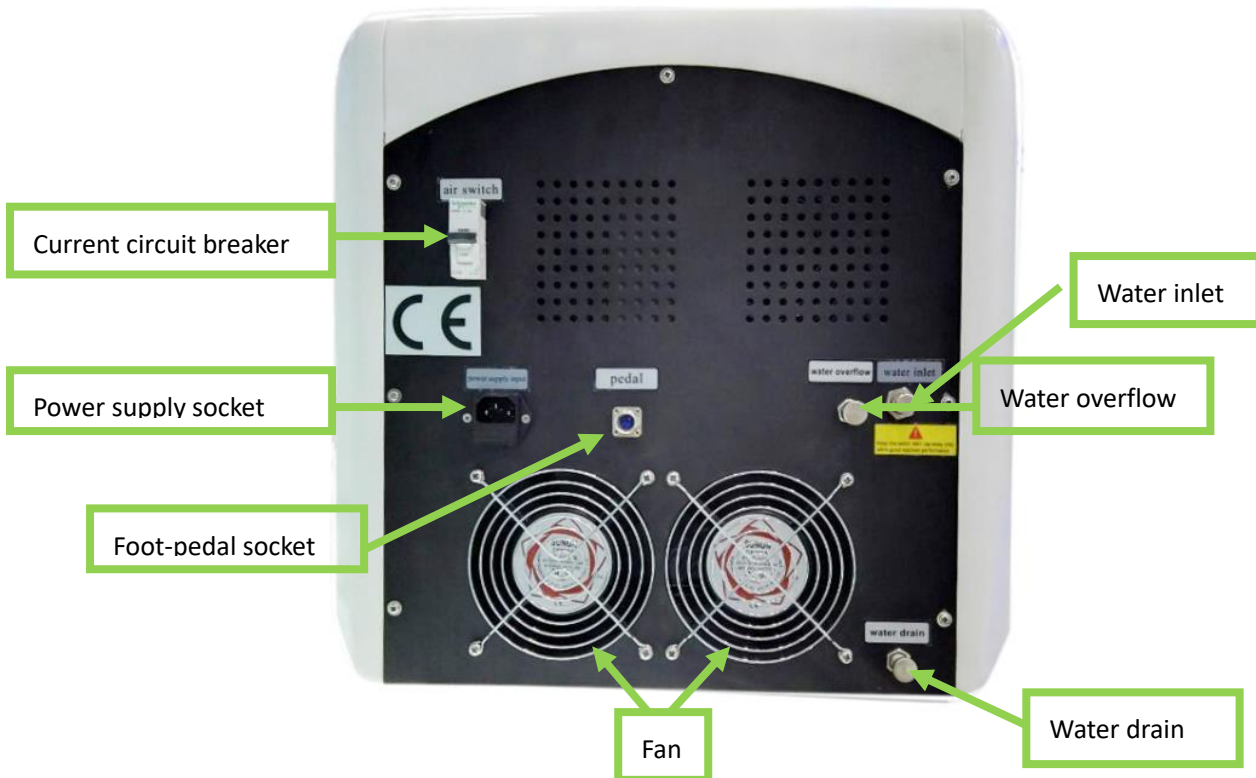
### III. Main machine



If you want to disconnect the handle with the machine, please use the red clamp connect with the two pins







## IV. Installation

Installation and debugging of the device must be performed by professional technical personnel who have been trained by equipment manufacturer and are approved to be qualified.

### CAUTION

- ◆ Do not install the product in the oily, smoky, damp and dusty area or the area which is easy to get splashed by water(rain)
- ◆ Install the product on a level area
- ◆ Do not bend the electrical cord or accessories using force or place a sharp or heavy object on them. (There may be a risk of electrical shock or fire.)
- ◆ Do not plug several power cords of electrical appliances into one receptacle at the same time. (There may be a risk of fire.)
- ◆ Check out for the rated voltage when you install the product. ( There may be a risk of circuit damage

or file unless the rated voltage is not used.)

- ◆ The person in charge of the handling the appliance should be familiar with all safety regulations.
- ◆ Every accessories needed to plug in with accurate position
- ◆ Problems occurring due to carelessness in using or managing the system in the middle of using it are excluded from warranty coverage for service.

### **Working conditions**

- a) Ambient temperature range: 16°C~28°C;
- b) Relative humidity range: ≤80%;
- c) Atmospheric pressure range: 860hPa~1060hPa;
- d) Power supply: 220V+10%, 50Hz; or 110V+10%, 60Hz

### **Transportation and storage conditions**

- a) Ambient temperature range:-10°C~60°C;
- b) Relative humidity range: ≤100%;
- c) Atmospheric pressure range: 500hPa~1060hPa.

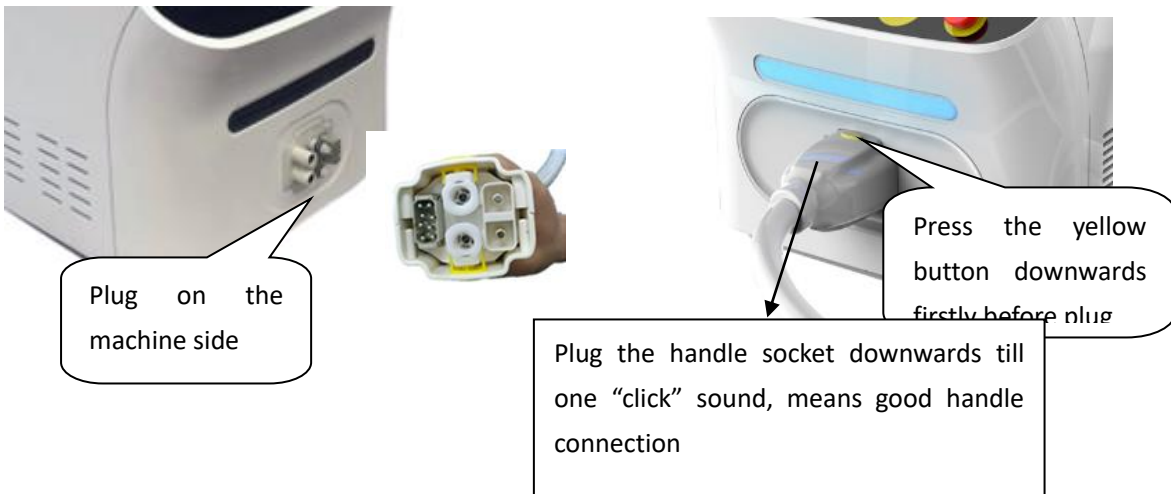
### **Installment procedure:**

1. Place the appliance in the special working area as above requirements.
2. Mount the handpiece holder on main machine with screws
3. Plug in the handle connector on main machine and ensure good connection

#### **Methods:**

- a. press down the yellow buttons on connector
- b. plug into socket on main machine until you hear click sound and the buttons bounce back.

See below pictures.



#### 4. Plug in the Remote Interlock Switch



5. Plug the foot pedal into the socket marking "foot pedal"



6. Add water into machine

**1) Water Source: deionized water**

**Change water every 2-3 months**

**How to add water?**

**2). Input water (see picture bellow)**

(1). Water source: pure water or distilled water;

- (2). Screw off the caps of water inlet and water spilt at the same time;
- (3). Connect water pipe and water funnel to input water



**(4). How to know enough water input?**

Please observe water spilt, water flowing out automatically from the water spilt, means enough water input.

(5). Pull out water pipe and water funnel, do not tighten screw caps until you turn on machine and have good water circulation inside machine.

**Notice:**

- After adding full water, please don't screw on the caps of water inlet and spilt water immediately, turn on the machine to make water run inside and let air exhaust, then screw on the cap of spilt water, but leaving the cap of water inlet still open (don't open it normally, except transportation).
- Under transportation, water must be drained and all caps have been screwed on!

7. Connect power cord with device and plug into a wall socket with grounded
8. Check the Emergency button is in release state
9. Switch on keys, the device is power on.

Waiting for a few seconds, the device will automatically complete preheating and enter into operation interface. (If there are problems in the cooling system, the temperature can't be controlled to the preset temperature; this condition is regarded as faulty. The appliances can't enter into operation interface and will always remain at the initial startup image).

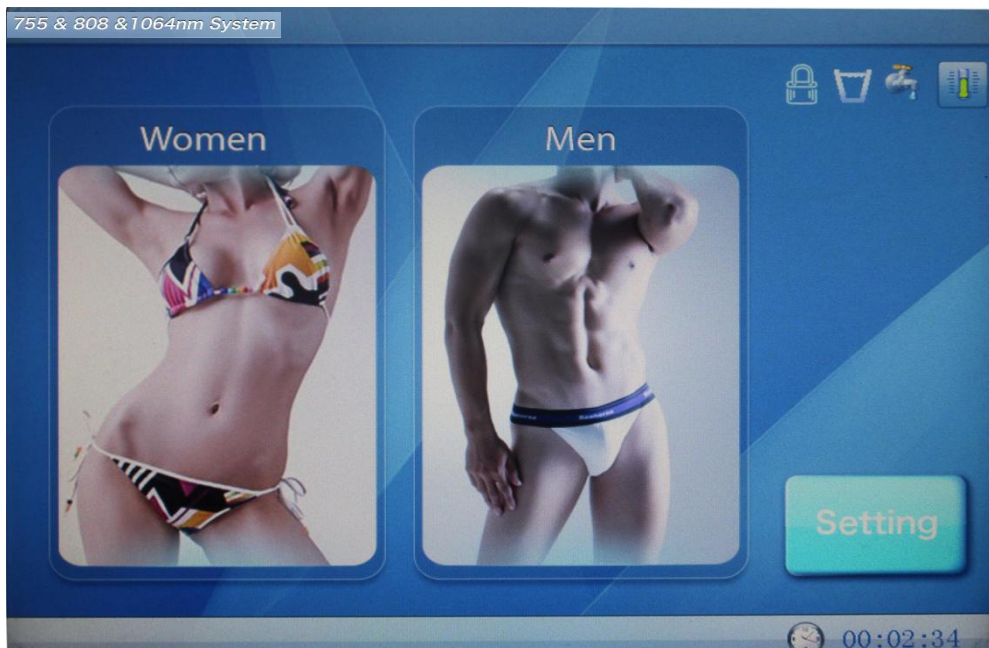
 **WARNING**

- ◆ If you have any problems with this product, immediately stop using it and contact us.
- ◆ Do not put any inflammables on the product.
- ◆ Do not disassemble, repair or remodel the product at discretion of a user. Please contact us for help to repair it. (There may be a risk of electrical shock or fire).
- ◆ Please contact us for a check or repair of the product for the following cases:
  - ✧ There is damage on a cable or plug, and the product doesn't work properly
  - ✧ The product was dropped and damaged
  - ✧ the product is wet with water.
- ◆ Please insert a plug in a wall socket with grounded
- ◆ Do not use a damaged electrical cord or aged receptacle. (There may be a risk of electrical shock or fire)

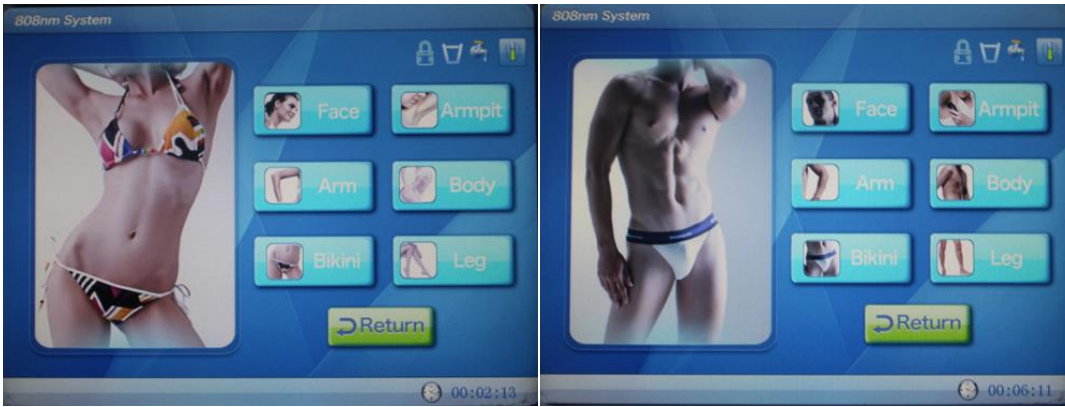
- ◆ Do not give a shock to the product or accessories
- ◆ If the output laser is too weak, or there is something wrong with laser output, turn to professional technical personnel for debugging. Do not debug the appliance without permission so as to prevent eye or skin from being damaged by laser radiation or scattered radiation.

## Chapter 4: operation instruction

### I. User Interface



1. Touch the **Women** or **Men** picture, go into below interface.

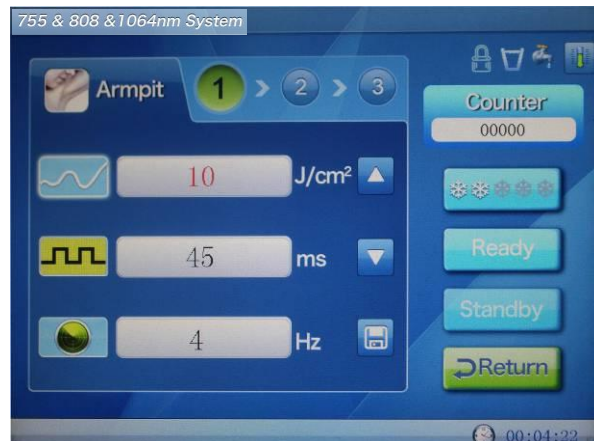
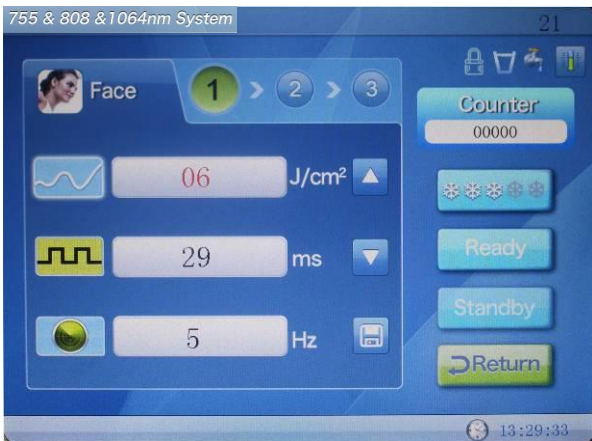


**For women**

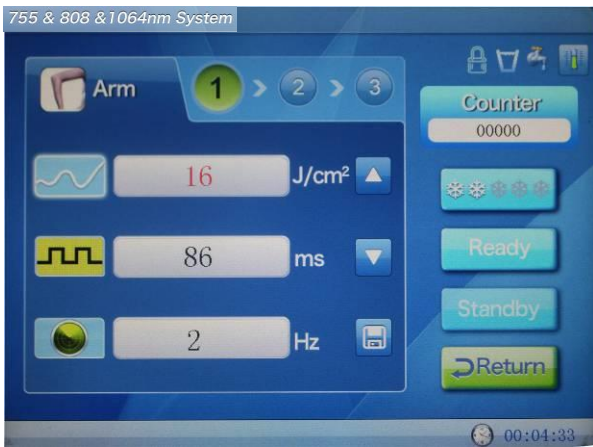
**For men**

**Optional 6 treatment menus:**

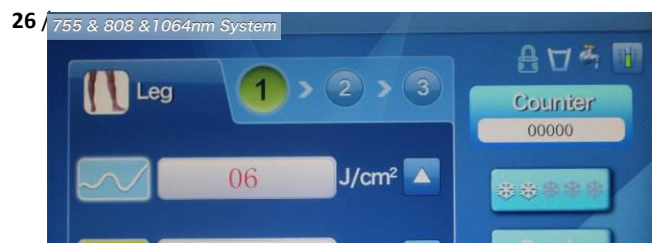
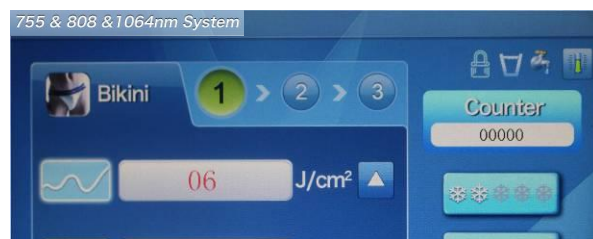
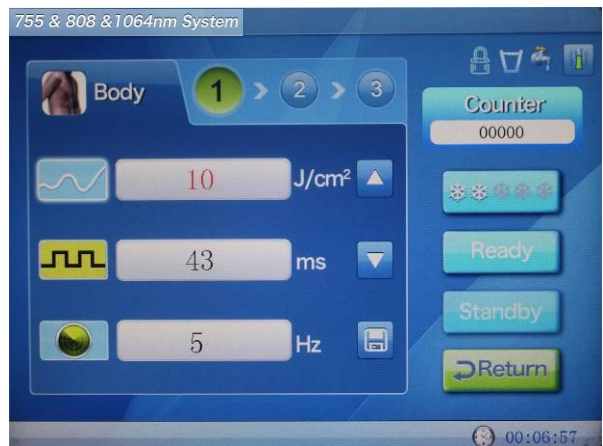
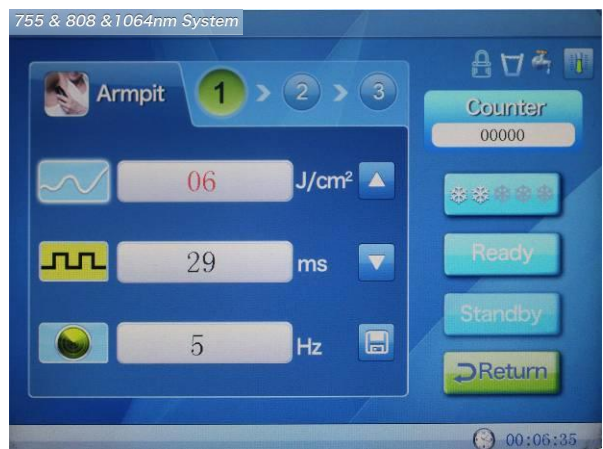
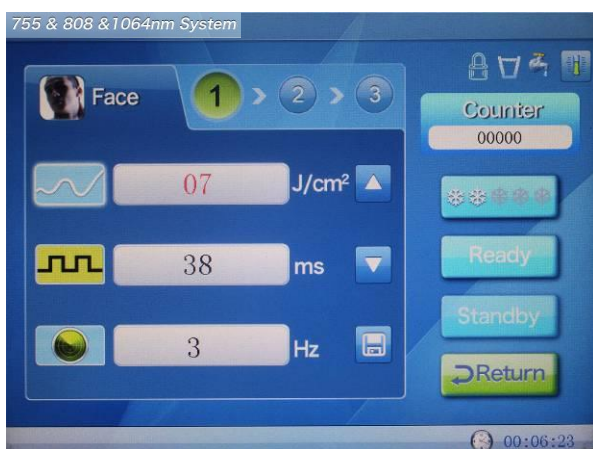
**a. For women:**



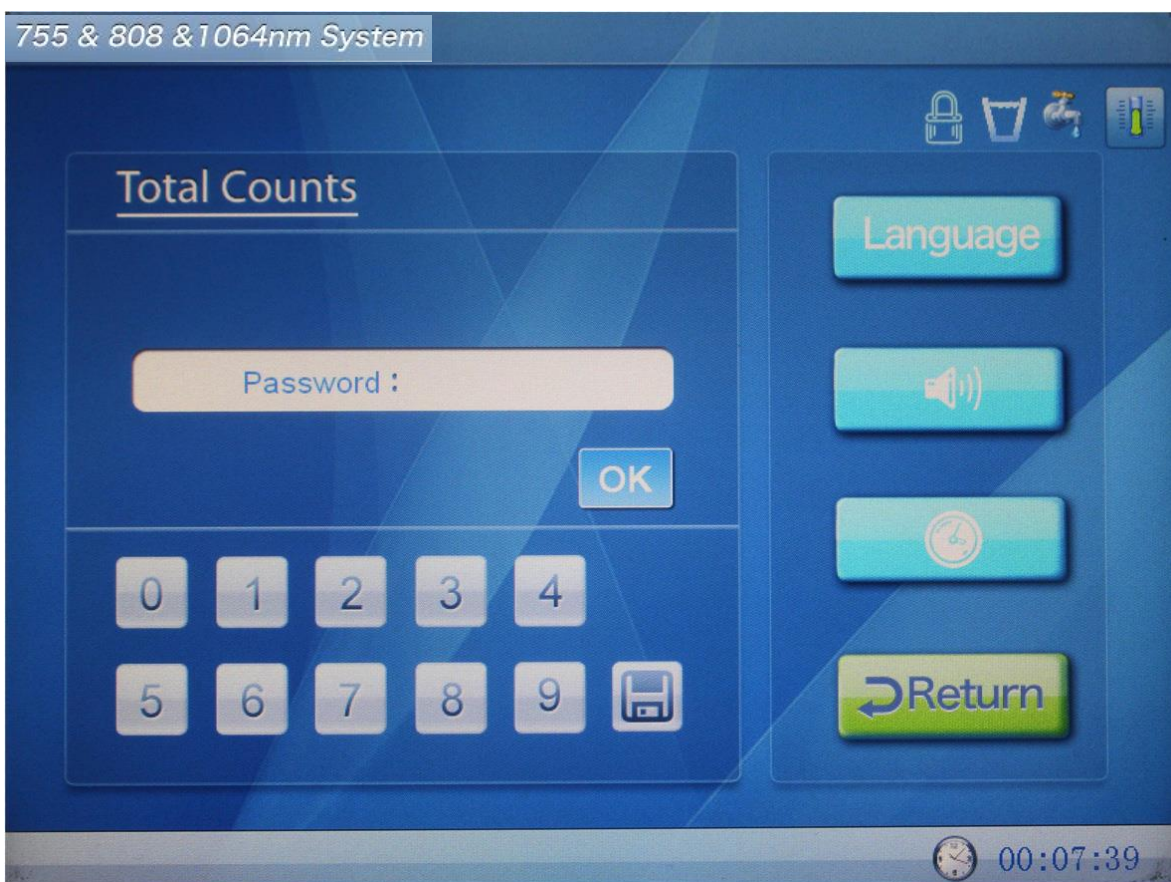




**b. For men:**



2. Touch “**Setting**” button, you can enter system setting interface



## II. Setting Instruction

### 1. Faulty Alarm Indication



From left to right: **alarm for interlock, water lever, water flow, water temperature.**

Any abnormal condition, it will alarm automatically at the first time and stop all working immediately.

### 2. Parameters Setting

Parameters can only be set under standby mode!



Save 3 groups of parameters



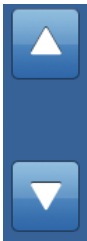
Fluence, range 1-120J, step 1J  
Touch this button first, then touch up & down arrow to increase or decrease fluence



Width pulse, range 8-685  
Touch this button first, then touch up & down arrow to increase or decrease width pulse (this setting is self-matching with fluence)



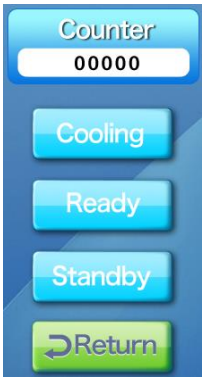
Repetition Rate: 0.5-10Hz  
Touch this button first, then touch up & down arrow



Up & Down arrow to increase or decrease Fluence, Width pulse, Repetition rate



Save the parameter settings



**Counter:** shots counter for each switch ON/OFF

**Cooling:** once you touch Ready, Cooling is activated automatically

**Ready:** touch Ready, the appliance enter the ready state

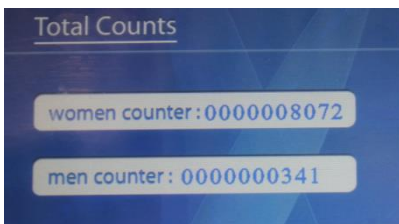
**Standby:** touch Standby, the appliance enter the standby state

**Return:** touch Return back to last interface

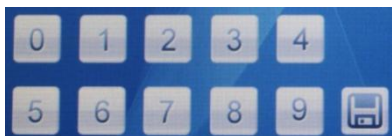


Cooling for machine

### 3. System Setting



Total counts for Women treatment and Men Treatment



Number input keys and save button



Standard language English, can't change



Touch-tone ON/OFF



Clock setting, Methods:  
1. Touch clock button, use number keys to input hours and save  
2. Use number keys to input minutes and save



Back to last interface

# Chapter 5 Clinical Application



**Warning:** please use the device after careful reading of the User Manual before operation!



- ◆ Do not put the handpiece to people's eyes directly to prevent from eye damage
- ◆ Be careful not to directly look at the light and lest it be reflected on the reflective surface
- ◆ In order to prevent the emitted or reflected light from being exposed accidentally, all persons in charge who are using this system should be sure to wear the protective glasses.
- ◆ Also be careful lest the light face eyes. Even in case that the output is low, you may suffer a fatal eye injury.
- ◆ Do not pull the power cord using force or touch the power plug with a wet hand. ( There may be a risk of electrical shock or fire).
- ◆ Stop using the product and unplug the power cord immediately when there is thunder and lightening or an earthquake. ( There may be a risk of electrical shock or fire)
- ◆ Dangers of explosions and fire
- ◆ Do not operate the device in a place where there are volatile substances like ductile anesthetics, alcohol, gasoline or solvents
- ◆ We recommend you to use nonvolatile substances or tools, if possible
- ◆ Always keep a fire extinguisher near the device



It requires an experienced therapist to use it and also patient cooperation for getting good results.

## I. Before treatment

- ◆ The first step in the treatment procedure is asking whether your patient has taboos (specified in Chapter 1) and did below things which decrease either the safety or effectiveness of their treatment.
  - a) Tanning should be avoided for 3-4 weeks prior to treatment. During the course of treatment, if a patient is exposed to sun, sunscreen with an SPF of at least 30 applied as a thick layer 20 minutes before sun exposure is recommended.
  - b) Patients should not wax, tweeze, bleach, thread, or use depilatory agents for 4 weeks prior to treatment. If facial hair is being treated, usually avoidance of these methods for only 2 weeks is necessary because facial hair grows faster. If a form of hair removal is necessary, shaving or clipping can be done because these methods allow the hair to stay in the follicle. It is usually advisable to see some hair growth on the day of treatment.
  - c) Lotions, creams, makeup, and deodorant should be removed before treatment as well. These can obstruct or refract laser light negatively.
  
- ◆ Evaluating your patient. Observe and document your patient skin color, hair color, hair type, hair density, and the treatment area.
  
- ◆ Discuss the treatment goals with your patient and establish realistic expectations based on the treatment area, her hair color and hair type. If your patient has fine, light colored hair, explain to her that it may take longer to achieve desired results.
  
- ◆ Be sure to photograph your patient's treatment area before the first session in order to establish a

baseline. It's important to rephotograph the patient before subsequent treatments in order to document the results achieved.

- ◆ Explain to your patient that during the course of the session, she may feel a gradual build-up of heat into the area being treated.
  
- ◆ Have your patient lie down, then shave and white clean the area to be treated. Using a red skin marker draw grids of boxes of approximately 10 by 10 cm or 4 by 4 inches in size on the entire treatment area. For larger areas such as the chest or back, draw grids of 5 by 10 cms or 2 by 4 inches. Apply a thin layer of pre-cooled ultrasound gel to a section of treatment area that includes at most 4 grids, the maximum area to be treated at a time.

## II. Starting treatment

- ◆ For eye protection, the last step before starting the laser treatment is to ensure that the treatment room door is locked, and that you, your patient and anyone else in the treatment room has put on protective eyewear.
  
- ◆ Let's set the system parameters to start treatment. We suggest you do a patch test with following method to get the appropriate parameters for each patient because each person has different skin impedance even same skin type

### *How to get appropriate parameters?*

- a) **Fluence** is the joules per square meters. Start from 5J to do patch test, if patient feels a gradual build-up of heat into the area being treated, the joules are right for doing treatment. If patient feels nothing, you need to rise the joules by 1 or 2 steps. (when you rise joules by one step, if patient

feels a little hot, you can pass the handpiece over treated area faster or decrease width of pulse a little bit, so patient feels comfortable.)

b) **Pulse width** is how long time one pulse working on skin. E.g., 10ms means light lasting 10ms on skin. When you rise joules, pulse width may also rise itself to match.

c) **Frequency** is repetition rate, means you press the trigger, how fast the shots are coming out. 3Hz means 3 shots per second. We suggest you use 3-5Hz. If you use it higher, you have to pass the handpiece quicker on skin, otherwise the shots overlapping on same area, patients may feel uncomfortable.

	Joules	Width of pulse	Frequency
Range	1J	10ms	0.5-10Hz adjustable
	2J	12ms	
	3-13J	18-78ms	
	14J	84ms	0.5-9Hz adjustable
	15-16J	90-96ms	0.5-8Hz adjustable
	17-18J	102-108ms	0.5-7Hz adjustable
	19-22J	114-132ms	0.5-6Hz adjustable
	23-26J	138-156ms	0.5-5Hz adjustable
	27-33J	162-198ms	0.5-4Hz adjustable
	34-44J	204-264ms	0.5-3Hz adjustable
	45-66J	270-396ms	0.5-2Hz adjustable

	67-120J	402-685ms	0.5-1Hz adjustable
Notice:	The pulse width will rise itself when you rise Joules, Generally, Joules: pulse width = 1:6. But it will not change itself when you reduce joules. Have a try by yourself for a better understanding.		

**Notice:** Dark skin absorbs light easily, please always start fluence from low setting!

**Clinic suggestion**

		Face	Armpit	Arm	Body	Bikini	Leg
Woman 1	J/cm <sup>2</sup>	10	8	15	16	6	16
	MS	60	48	90	96	36	96
	HZ	0.5-3	0.5-3	0.5-3	0.5-4	0.5-3	0.5-4
Woman 2	J/cm <sup>2</sup>	11	9	16	17	7	17
	MS	66	54	96	102	42	102
	HZ	0.5-3	0.5-3	0.5-4	0.5-4	0.5-3	0.5-4
Woman 3	J	12	10	17	18	8	18
	MS	72	60	102	108	48	108
	HZ	0.5-3	0.5-3	0.5-4	0.5-4	0.5-3	0.5-4
Man 1	J	8	8	15	16	6	16
	MS	48	48	90	96	36	96
	HZ	0.5-3	0.5-3	0.5-4	0.5-4	0.5-3	0.5-4
Man 2	J	9	9	16	17	7	17
	MS	54	54	96	102	42	102
	HZ	0.5-3	0.5-3	0.5-4	0.5-4	0.5-3	0.5-4
Man 3	J	10	10	17	18	8	18
	MS	60	60	102	108	48	108
	HZ	0.5-3	0.5-3	0.5-4	0.5-4	0.5-3	0.5-4

1 is for black skin, 2 is for other skin, 3 is for white skin.

**Clinic phenomenon**

	Energy	Width of pulse
Reference parameter setting (suitable for black, brown, white skin)	Start from 5J and then adjustable as actual patient's condition.  Note: the energy value is most important value setup in the whole treatment, so please adjust from lower to higher in step.	This value will rise at the same time as energy rising. Please look at the following trend of parameters setting
Clinic phenomenon	For a right parameters setting, the client will have the feeling of acupuncture under skin tissue obviously, and then feel warm at the same time; but all feeling must be acceptable by clients. Generally, skin turn to little red after treatment and will disappear in future 1 hour. Frequency of spots: repeat treatment for 20-30 shots at the same place, but not mean keep 20-30 shots staying at the same place in one time. For instance, you want a treatment for the whole leg. Firstly should set up correct parameters vertical put probe on skin (leg) and make sure probe closing touch skin touch "ready" on LCD display continuously step and press control button on handpiece at the same time laser shooting slide handpiece from one side of leg to another side, and then repeat from one side to another side on leg till 20-30shots to each place.	

- ◆ The first step in the treatment is to apply the handpiece to the treatment area and ensure there is complete contact with the patient skin. With your foot holding on the foot switch, and press the trigger on the handpiece to initiate release of energy.

**Treatment Method:**

Starting at the top left corner, immediately perform one pass of horizontal sweeping paintbrush movements over the treatment area. Then release the trigger, reposition the handpiece at the top left corner and perform one pass of vertical sweeps over the area. The sweeps should be performed

at the rate of 5 centimeter or 2 inches per second as demonstrated. Repeat this until you see below skin signs.

- ◆ Observe the treatment area for signs of skin erythema, Perifollicular erythema and possible edema. If these are apparent, you have reached the endpoint of treatment. You can reassure the patient that this redness and swelling is normal, and would disappear within a few hours. If the signs are not visible, as maybe the case with the fair skin and light color hair, immediately perform more sweeps over the area.
  
- ◆ Gently remove the ultrasound gel from the treated area, and apply Aloe Vera gel to enhance healing.
  
- ◆ Apply ultrasound gel to the next 3 or 4 grids, and continue treatment until you completed the entire treatment area.
  
- ◆ After treatment, take soft gauze mat for to clean handpiece 100% and keep it dry.

### **III. Post treatment**

Instruct your patients that:

- ◆ In order to avoid hyper or hyper pigmentation, your patient should apply sun cream (SPF 30 plus) daily on the treatment area, and from sun bathing and tanning bed for 3 weeks.
- ◆ your patient should also avoid solars, hot bathes, and other leisure activities which can increase skin temperature for a period of 2 days following the treatment.
- ◆ if your patient had the treatment done on the face, he can put makeup on almost immediately unless there is blistering. If he do use makeup, make sure it is new makeup to prevent any sort of infection

and make sure he has moisturizer under the makeup. The moisturizer will help his skin heal.

- ◆ your patient can shower but he should make sure that he gently wash with a mild soap. If he had her underarms treated, do not put on deodorant for the first 24 hours at least, ideally use a powder instead of deodorant for 24 hours after the treatment to reduce skin irritation.
- ◆ we recommend avoid clothing that is tight or coarse and lightly to cause friction with skin for 2 days following treatment.
- ◆ your patient should expect to observe some normal shading of hair in the treatment area within 7 days. Emphasize to him that he observes any regrowth of individual hairs, he should not remove them by plucking, tweezing or any other means during the entire course of treatment.

## IV. Sessions

Hair grows in three cycles, anagen (active growth phase – laser hair removal only affects this stage), catagen (regression phase) and telogen (resting phase). At any one time, only a certain percentage will be in the anagen phase (approximately varies from 10 to 25%), which is the reason why you need multiple treatments.

For large treatment areas, the interval between treatments should be 6-8 weeks. While for small treatment areas, the interval should be 4-6 weeks. The average number of total treatments is between 6 and 8.

### ◆ Clinical Features

#### a. Treatment features

The basic working principle of diode laser hair removal instrument is based on biological effect. This product adopts the laser with the wavelength of 808 nm for irradiation, which are particularly sensitive to the melanocyte of hair follicle with no damage to normal epidermis. The light can be absorbed by the melanin in the hair shaft and hair follicles and is transformed into heat, thus increase the hair follicle



temperature, when the temperature rose to a higher extent, the irreversible damage can be produced to the structure of hair follicle, thus, the damaged hair follicles can be removed after a natural physiological process, so as to achieve the purpose of permanent hair removal.

This product is of novel design with stable operation; also, it is short for the irradiation time with lasting effects; it is easy to operate and have good clinical efficacy with high safety factor.

#### **b. Clinical effects:**

**Safety:** Diode laser of 808 nm has stable performance, long service life; also, it adopts the intelligent microprocessor for real-time control.

**Quick:** big square laser spot of 12 mm \* 12 mm, provide large-area hair removal with high efficiency and speed.

**Effective:** Laser wavelength of 808 nm, is in the spectrum of near infrared (0.75 ~1.50 $\mu$ m) region with good melanin absorption, can penetrate the deep dermis and subcutaneous adipose tissue, acting on the different sites and depth of the hair.

**Painless:** The sapphire cooling window can cool the epidermis to 0~3°C. The whole course cooling provides appropriate feeling with no pain.

**Convenient:** The human-machine interface - touch screen, intuitive and easy-to-use, therefore, its operation is simple and convenient.

**Permanent hair removal:** Suitable for the hair from all types of skin color with good hair removal effect.

## **◆ Potential Risks**

The most common complications for using diode laser hair removal instrument are postoperative local erythema and follicular edema, most of them can disappear of themselves after a few hours. Rare complications are the local scab, purpura, blisters, pigmentation or hypopigmentation and increased sebum secretion. The occurrence of adverse reactions after laser hair removal, mainly relate with the

energy density and the epidermal melanin content, meanwhile, it has obvious relationship with the seasonal changes, treatment sites and solar radiation, the adverse reactions can be minimized on abiding by the preoperative and postoperative guidance and the correct operation.

## ◆ Attentions in clinic

- a. Generally it's close related to the energy density, treatment result and inflammation condition after skin impaired. High energy density will make a better effects but bigger inflammation reaction at the same time; as well as deep skin impaired accordingly. Energy starts from lower energy in treatment, and increase energy density little by little till a better effect.
- b. The biggest permitted energy and skin's pigment are in reverse proportion. Generally dark skin with lower energy density, to reduce laser absorbing at epidermis or turn to warm. Good cooling system is very important in treatment and protects skin burning greatly, much better to the dark skin.
- c. Shave the unwanted hair before operation, because the visual hair will absorb laser energy and create heating at epidermis, which may causes partial skin burning and damage laser probe.
- d. Good cooling system will reduce temperature at epidermis. Cool probe is helpful to increase permitted energy density and partial anesthesia. Strong suggest adopt cooling mode in the whole treatment, specially to the dark skin. Dark skin is more easy to absorb energy than light skin.

# Chapter Six: Working Principle

## I. System Principle

Diode laser hair removal machine is a device which adopts the high-energy and continuous diode laser to realize the conversion of electricity, light and heat energy, and thus achieves hair removal treatment. Therefore, this is a laser therapeutic product that integrates laser technology, electronic technology, computer science and medical science.

Working principle of diode laser hair removal machine is as follows: under the control of microprocessor, laser power supply can provide the adjustable constant current for the laser module, the high power laser diode in the laser module can transform the electric energy into the light, generate the continuous laser beam with a wavelength of 808nm. Through the light crystal, the laser beam can irradiate the tissue to be de-haired, pass through the external layer of skin and arrive the roots of hair follicles, the light energy is absorbed and converted into the thermal energy for destroying hair follicles, so that make the hair to be lost and lose the regeneration capacity, reaching the permanent hair removal purposes.

Parameters that needed in the treatment course, such as laser energy density etc, shall be set by users according to actual conditions.

## II. System composition

Diode laser hair removal instrument is composed of the power system, microprocessor control systems, and operational display systems, cooling systems, laser module and the security alarm system, as shown in Figure 1.

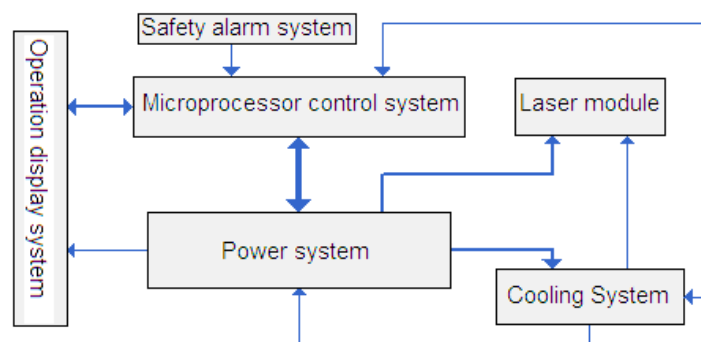


Figure 1 System block diagram for Diode Laser Hair Removal Instrument

### a) Power System

Power system including network power supply, laser power supply system, refrigeration power supply

system and auxiliary power supply system, as shown in Figure 2

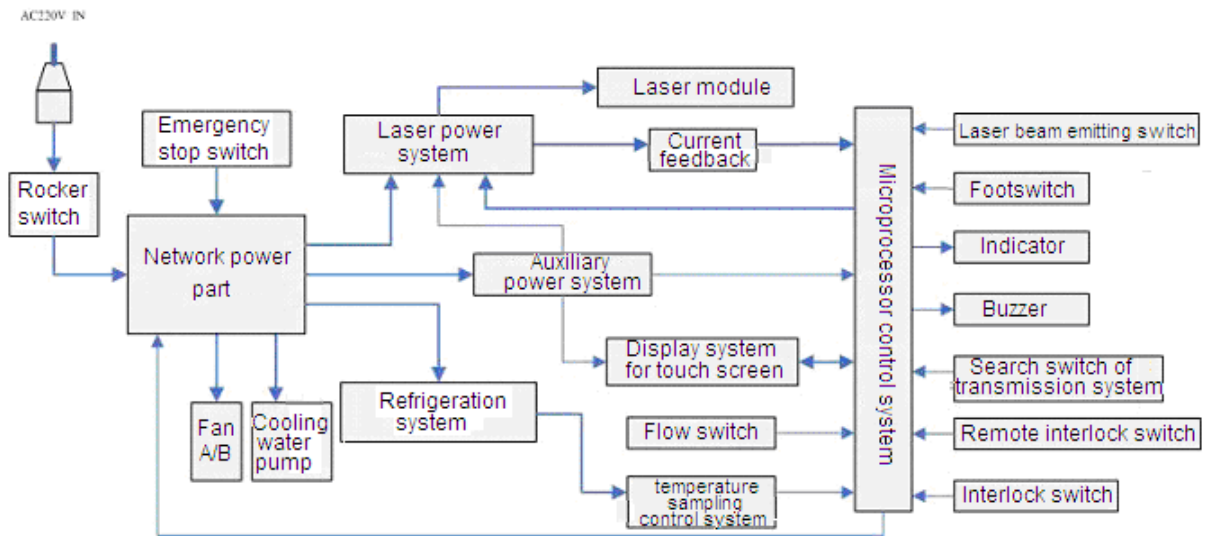


Figure 2 circuit block diagram

The power lines and rocker switch are used to control the on-off of hair removal instrument with the outside power supply. The key switch, emergency stop switch are used to control the on-off of network power, and then through the auxiliary power supply, provide the work current for the microprocessor control system, touch screen operation display system and other functional components, meanwhile, the on-off of power system for refrigeration and laser are realized by the pick-up and switching off of the relay that controlled by micro - processor. The power-on , energizing and the light emission process of main unit are subject to microprocessor control, in order to achieve controlling the hardware with software through microprocessor, so that the appliance operation are more stable and reliable.

Laser power system adopt the power devices to constitute current regulation loop, thus can change the volume of output current through system regulation power devices of microprocessor, thereby controlling the volume of output laser energy and work pulse width, through the feedback loop, export the current sampling signal and send to the micro - processor for real-time monitoring.

Various power supply components from the power system of laser hair removal instrument mostly adopt the safe and reliable switching power supply to achieve AC-DC conversion, these components passed through CE- certification, so that the safe effectiveness of the system get adequately guarantee, not only ensure the personal safety of users, but also ensures the long-term and reliable work of the devices itself.

The power system has the perfect self-protection function, it can continuously feed a number of important signal back to the microprocessor, once the important signal has an error, the microprocessor will promptly notify the users through the friendly man-appliance interface (Touch Screen) and take automatic protection treatment .After the error signal is released, the power system can automatically return to normal state.

## **b) Microprocessor Control System**

Diode laser hair removal instrument adopt the microprocessor control system. The microprocessor control system is composed of microprocessor, control loop and detection circuit, see Figure 4.2.

Control module of hair removal instrument is highly automated, the user just needs to turn on rocker switch and key switch and eject emergency stop switch, after power-on, the system will automatically perform the self-check for the control system (include all the preset checks against some possible damages to the appliance and the user) and the calling of treatment parameters and other a series of actions.

If error occurs for self-check, the fault information will be displayed on the touch screen after system initialization, system self-check and parameter call-up are finished. This helps the user and the service personnel to get to know the running state of the appliance. If no error alarm arises, the user can turn on/off laser power supply, adjust output laser parameters and adjust laser operation mode through the

touch screen. And through the touch screen, the user can also control whether to ignite lamp and whether to yield laser.

### **c) Operation Display System**

Operation Display System is composed of touch screen, indicator and buzzer.

Among them, the touch screen connect directly to the host microprocessor, the operator can operate the touch screen to control the microprocessor to work, and through the information that is displayed on the screen to understand the main unit state and the relevant parameters, the hair removal instrument adopt the safe and reliable touch screen that passed through CE certification, also, the manufacturer designed a simple and intuitive operational interface, which can be easy to realize man-machine dialogue.

The indicators are used to display the work state of main unit; meanwhile, the buzzer is used as the prompt for laser output and fault alarm.

### **d) Cooling System**

Cooling system consists of cooling fan, cooling water recirculation system and water temperature regulation system.

After the laser hair removal instrument starting, the cooling system begins to work and adjust the water temperature to the pre-set temperature scale. The cooling fan give air cooling for the electric parts and radiator in the main unit, through air flow in the appliance to take away the generated heat.

When the laser is running, internal circulating water can displace and takes away the heat and deliver to the water temperature regulation system, where the heat can be displaced and sent to the radiator for dispersion. Therefore, the circulation water temperature is maintained within a dynamic balance range,

this ensures the normal working temperature of laser. By monitoring cooling water temperature in real time through temperature sampling, the control system can start the cooling components from the water temperature regulation system in due time to adjust water temperature, also, it can automatically judges whether the temperature is normal. If the temperature exceeds the early warning value that pre-set, the system will automatically disable laser output and give alarm so as to avoid damage to the laser.

## Chapter 7: Daily Maintenance

### I. Fault Alarm

The hair removal machine has multiple protection function including: **interlock, water flow, water level, water temperature.**

When there is abnormal condition in the main unit, the system will disconnect the laser power and display itself in the way of indicators from the protecting designator of touch screen (under the normal circumstances, the indicator shows green, in the event of a failure, the indicator shows red), at the same time, the buzzer will make continuous alarm sound. Once the fault clearance is detected, the alarm screen and the alarm sound will automatically disappear. During treatment, if the same warning screen appears more than three times, please contact the personnel of after-sale maintenance.

#### **Before calling for Service**

##### **1. Safety interlock switch alarm:**

Check whether the shell is opened or loose, whether the remote interlock is in open circuit condition.

##### **2. Water flow alarm**

Check whether there are water shortages in water tank, or leakage from water pipes and radiator

### **3. Water level alarm**

Higher or lower flow level, it can't work normally. You need to check up whether enough water at the first time and turn off machine immediately.

### **4. Water temperature alarm**

Restart the appliance after shutdown or stopping emitting flashes for some time.

If there are no above mentioned conditions, please contact the personnel of after-sale maintenance.

## **II. Maintenance**

Maintenance is necessary to ensure that the hair removal machine works in a good condition.

Great care shall be taken in maintaining the hair removal machine since the laser medical device is a precision appliance.

### **1. Check or replace the power fuse**

Shut down all the power switch, pull out the power cord plugs; Use one small flat screw driver to gently turn the protective tube casing in an counterclockwise manner and then take out the protective tube, then take out the fuse from protective sheath;

Only the fuses with standard type which specified by the manufacturers can be used for replacement (fuse type: 10A/250VAC); put in the fuse tube and the sheath and tighten the sheath up clockwise, re-insert the power cord to the back of machine, then connect the electricity, turn the power switch and key switch on , verify that whether the machine is working correctly.

### **2. Main unit maintenance**



A shield should be covered if the equipment is not used for long time, this can prevent the pollutants as dust and water vapor from entering into the inside of main unit, these pollutants could lead to the decrease of laser output energy, and even affect their normal operation, therefore, it is requested that the equipment installation sites must be clean, dry and dust-free ,also ,the ambient temperature is preferably maintained at 4 ~ 40 °C. In order to avoid the appliance casing and components aging, the main unit can't be put in strong direct sunlight; it should be installed in a dry, ventilated place with no corrosive gases. In the region with the temperatures below 0 °C, it is proposed that the cooling water in the main unit should be emptied out during transport process or not to be in use for long time, this can prevent the liquid icing and expansion and damage the related components in the equipment (it is recommended that the discharge should be conducted by the qualified professionals from manufacturers or directly contact to the manufacturers).

### **3. Laser handle maintenance**

Laser handles is composed of precision optical components, therefore, it should avoid falling and getting blunt force, the laser handles couldn't be collided or turned on arbitrarily, otherwise, the laser module will not emit light normally; the cleanliness of end plane of light guide crystal has significant impact on the laser output, so the inspection and proper cleaning must be given before application. When using the handle transmission system, it should try to avoid the damage caused by extreme bending.

### **4. Cooling System**

Regularly check to ensure the cooling fan works normally. If the cooling fan or cooling module fails, therefore, the appliance lose heat exchange path with the external environment and heat will accumulate inside the appliance, and as a result, the laser may fail to work normally, or even cause damage to hair removal machine. On overhauling the appliance, the maintenance personnel should detect the storage volume of water tank and water quality, as well as refrigerating capacity of the appliance, if any exception occurs, the cooling water should be added or replaced timely.



**Note:** the cooling water used for the hair removal machine must be deionized water ( PH value of water 5.5-8, hydronium water resistance:  $5M\Omega/cm^2$ )

5. During transport process, if want to lift the appliance, the force point must be in the frame, the casing and the handle may not be imposed on force, since the handle is only for movement. On normal application (emitting laser beam), the hair removal machine can not be moved and can not be over-tilt (gradient  $\leq 5^\circ$ ).
6. Non-professional maintenance personnel shouldn't dismount the main unit, laser handle, foot switch as well as other accessories, if there are quality problems, please contact your local dealer.
7. During storing process, the hair removal machine should be tested once a week, the power-on and off condition for "power switch", "key switch" and "emergency stop switch" are detected. If any exception occurs, please pull out the plug of power supply and contact the manufacturer.

### III. Install water file and change the water filter core:



## Instruction of install the filter:

- a) The door of filter is a magnet design. You can open it very easily like the picture above.
- b) the figure B is the filter which installed well

### **if want to disconnect it, the steps as below:**

Firstly, please unscrews the two screws in red dots, secondly, disconnect the water pipe (the method is pressing on the black edging of water nozzle by your hand, pulling down the water nozzle by your another hand. ). Meanwhile, the complete filter can be taken out.

### **Notice, when you install the filter, please insert the water pipe in water nozzle end**

- c) After change the filter, please install it according to opposite steps when remove it.

## The method to change the water filter core:



Instruction of change the water filter core:

Figure 1 is the water filter and spanner which for disconnect the water filter.

Figure 2 -3 shows how to take apart the water filter

Figure 4 is the photo after take apart the filter (please take out the filter core and clean the shell of filter, put a new filter core inside, then screw up the filter), figure 5 is a new filter core.

Figure 6 shows after put a new filter core, figure 7 is the photo after change the new filter core well.