

SERVICE & INSTRUCTION MANUAL

ELECTROSURGICAL GENERATOR

SMART 4 PLUS

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1. GENERAL INFORMATION

1.1 INTRODUCTION

- ◆ **Solid State Electro Surgical Unit**
- ◆ **Model: *SMART 4 PLUS***
- **Operating Manual**

Thank you for purchasing the *SMART 4 PLUS* unit. To use the generator properly and to get the best from it carefully read this operation manual use. After reading the manual, we suggest you to keep it in a convenient place for quick reference.

In order to instruct the user of an **Electro Surgical Generator** of the capabilities and limitations of his Generator a Greater deal of information must be provided. The user must be given more than the facts and specifications. Ideally he should be given a complete understanding of this equipment so he can use the generator in all situations and recognize potential hazards before they occur.

Taking into consideration all the above factors we have tried to make this manual more user friendly.

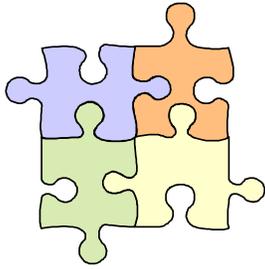
1.2 SCOPE

- **Congratulations**

Our new *SMART 4 PLUS* is the most versatile **Electro Surgical Generator**. It offers features and performance never before available in a single generator.

The *SMART 4 PLUS* has spray coagulation which rivals the best spark gap generators and with minimum cutting effect. The blend gives a good Hemostasis effect than cutting and pure cut is exceptionally smooth and starts promptly even in irrigated procedures. The isolated bipolar output, which has a non-sparking characteristic, is ideal for microsurgery, Neuro Surgery, Laproscopy and other applications.

SMART 4 PLUS meets the surgeon's needs in the wide range of general procedures and in specialties including Gynecology, Urology, Neurology, Thorasic, Plastic and Reconstructive Surgery.



2. INSTALLATION

2.1 UNPACKING AND HANDLINGS

Carefully unpack the package and remove **SMART 4 PLUS** from its packing material observes for the mechanical damage. Return the instrument if any mechanical defect is observed. Check the **SMART 4 PLUS** proforma to ensure receiving of all accessories.

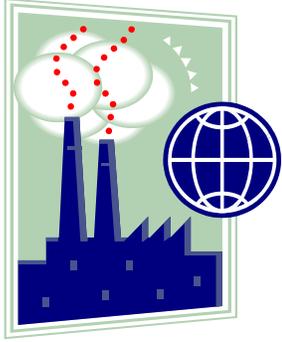
Accessories

1. Monopolar and Bipolar Footswitch
2. Stainless steel patient plate
3. Cord for patient plate
4. Monopolar chuck handle
5. Set of Reusable Electrode Knife, Needle, Ball

2.2 PRE-INSTALLATION REQUISITES FOR SOLID STATE E.S.U

Electrical requirements

- i.** This machine has inbuilt power supply, so there is no need of any external power supply to be connected. Use 230v single-phase $\pm 10\%$ power supply.
- ii.** Operating room should have a good clean grounding (Earthing). Use of copper wire as grounding cable is recommended.
- iii.** All 3-pin sockets (**5 Amps or 15 Amps**) on power supply board should have 3rd pin grounding connection (marked as “E” on socket and plug). Periodic checking of this Earthing is essential.
- iv.** Voltage between neutral and earth (ground) terminals of power supply board should be less than **1.8 volt** as per specifications.
- v.** If this low voltage limit is not achievable easily, then use of ultra isolation Transformer (in addition to voltage stabilizer) is recommended. Isolation transformer ensures proper electrical isolation together with a separate clean grounding.
- vi.** All operation tables in the theatre should be permanently grounded. Use good quality copper wire for this purpose.
- vii.** It is essential to check periodically the grounding system of O.Rs. with respect to operation tables and leakage voltage measurement between power supply neutral and Earthing terminals.
- viii.** Grounding point of operation table and that of power supply system should be the same (equipotentials) lengths of these grounding cables should be as small as possible.
- ix.** The earth terminal cable or grounding cable should not be connected to patient plate either directly or indirectly. Patient plate should not have contact with any grounded object including operation table.



2.3 ENVIRONMENTAL REQUIREMENTS

- i. Operating room should have adequate number of air conditioning unit to ensure proper low temperature and humidity depending upon surgical specialties.
- ii. If A/C units are not working, air-circulating fans should be directed towards surgical diathermy unit to dissipate the generating heat.
- iii. Use only electrically conductive jelly specifically recommended for radio frequency applications. (**550K c/s** suitable for other diagnostic applications.)
- iv. Periodic inspection and checking the working of patient protection circuit is recommended if provided. (Preferably after every **4 months** interval).
- v. Use and avoid spilling of proper solution over and near by the patient plate.
- vi. Check cable connection of metal plate with Diathermy unit every day. Loose connections if any should be tightened immediately.
- vii. Refer to safety tips and preventive maintenance notes.



3. UNDERSTANDING ELECTRO SURGERY

3.1 INTRODUCTION

Electro surgery is process of tissue cutting and coagulation in body by an electrode during surgery. It utilizes a sufficient high radio frequency electric current. High frequency surgery should not be mistaken for diathermy, electric cauterization, spark generation or similar methods.

It consists of non-traumatic method of tissue cutting and gentle coagulation. The result of this cutting method known as high frequency section are obtained without pressure or crushing of tissue cells. This effect is result from the heat that is generated through the electrical resistance of tissue when a current is produced by high frequency waves. The heat makes the intracellular water boil, thereby causing an increase in intracellular pressure and rupture of the cell membranes. This process is called **cellular volatilization**.

BASIC CONCEPTS IN ELECTROSURGERY AND PRINCIPLE OF RADIO FREQUENCY WAVE.

The instrument is designed to provide the correct electrical waveforms to deliver to the site of surgery in order to coagulate **blood vessels** and to cut tissues smoothly. Surgeons may use the electro surgery tool instead of, or in conjunction with, a conventional scalpel. When used properly, the electro surgery unit damages tissue considerably less than the scalpel, with the added ability to stem bleeding safely.

In bipolar procedures, the radio frequency was flows from an active electrode through a limited amount of tissue between the two electrodes.

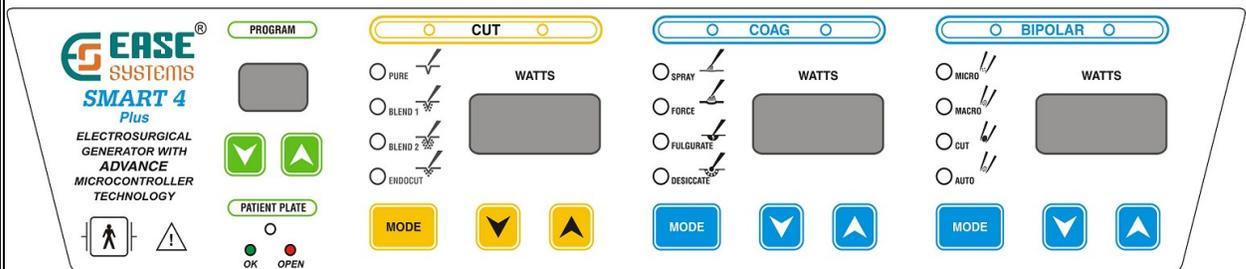
3.2 SALIENT FEATURES

- Body Protected and cardiac protected design.
- Four Modes of coagulation
- **Spray** – Mode offers massive & rapid non-contact coagulation.
- **Force**- pure coagulation.
- **Fulgurate** – To provide effective non-contact coagulation from distance, mainly appreciated by Urosurgeons and cardiovascular surgeons.

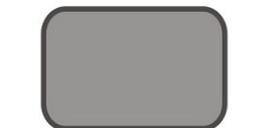
- **Desiccate** – mode delivers better coagulation with less depth of tissue necrosis. –
>Fulguration - ->spray- To facilitate contact coagulation for precise control of individual bleeder.
- Four modes in **CUT**
- **Pure cut** with two additional **BLEND 1 & BLEND 2** modes to give a surgeon, varying degree of hemostasis while cutting. **Endocut** mode is for added flexibility.
- **Separates Monopolar and Bipolar** mode with individual foot-switches.
- **Bipolar feature-** When generator is switched to bipolar mode; all the Monopolar activities associated with hand-switch or foot-switch, are automatically stopped to prevent uncalled burns. Bipolar provides coagulation without charring, adhesion and blanching of adjacent tissues
- **99 program modes** : User settable program mode.
- Patient Plate Alarm Systems
- HF Leakage current >150mA

3.3 OPERATING CONTROLS

(FRONT VIEW)



PROGRAM

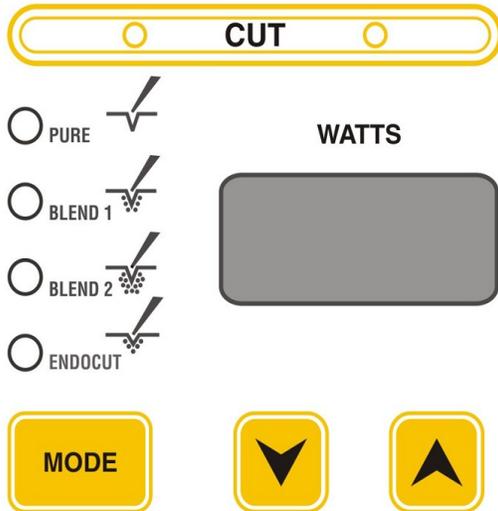


◆ **PROGRAMMABLE MODE:** user settable Program mode.



CUT MODE:

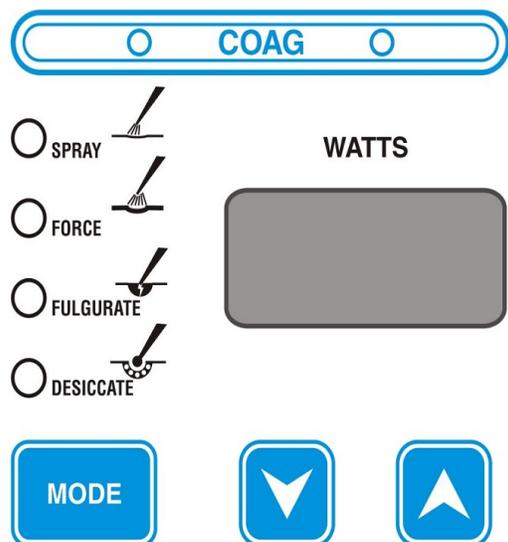
- ◆ **CUT-** In cut mode there are four settings.



- **PURE CUT-** A high-frequency alternating current yields smooth, rapid cuts that evoke little to no hemostasis
- **BLEND 1** - Preset blended cut modes give the surgeon varying degrees of hemostasis in cut mode.
- **BLEND 2** - The mode is used for the vaporization of prostatic tissue or any fat tissue. The higher output wattage gives fast cutting effect of the tissue
- **ENDOCUT-** The mode is used to automatically control cut system to reduce the complication rate of endoscopic sphincterotomy (EST) and serum hyperamylasemia after EST compared to the conventional blended cut mode.

COAG MODE

- ◆ **COAG Mode** : In coag mode there are three settings.



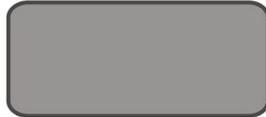
- **SPRAY** - spray output is made for direct coagulation at the tissue with spark. Above spark does not give any cutting effect as its CREST FACTOR is high.
- **FORCE**-Pure coagulation.
- **FULGURATE**- Sparking the tissue to lead to coagulation. There is no tissue-electrode contact; rather, voltage is raised in order to incite a spark between electrodes in order to coagulate the tissue in between.
- **DESICCATE** - Coagulation in which the active electrode is in direct contact with the tissue is referred to as desiccation and is the type of coagulation used in most surgeries It ensures pinpoint desiccation with less destruction of peripheral tissue.

BIPOLAR MODE

- ◆ **BIPOLAR Mode** - In bipolar modes there are three settings.



WATTS



mode.

- **MICRO** - High voltage force coagulation for special purpose when speed is required.
- **MACRO** - for highly precise control over coagulation process and privations of carbonization.
- **CUT** - Bipolar CUT technology lets you nearly eliminate excessive current, even during precision cutting in minute tissue structure.
- **AUTO MODE** - coagulation start by pressing the footswitch and stops output and audio signal automatically when the tissue is coagulated.
- Separates Monopolar and Bipolar mode with individual foot-switches.
- 99 program modes: User settable program

OPERATING CONTROLS (RARE VIEW)



PHOTOGRAPHS	DESCRIPTION
	<p>On / off switch - This switch illuminates to indicate the main switch is on. Push the switch up to turn the main power on.</p>
	<p>Mains cord- is use to supply 230VAC Input to machine</p> <p>Mains Socket - The three - prong plug on the power cord connects to the mains receptable providing 230 volts 50HZ power.</p>
	<p>Audio Volume Dial - Dial controls the audio volume from inaudible to 65 db.</p>

3.4 OPERATING INSTRUCTIONS

1. Plug the power cable into **230 V ac., 50Hz** outlet. Make sure outlet is Switched OFF before inserting the power cable.
2. Insert the active accessories into the front panel receptacle
3. Connect the footswitch cable to the front panel connector.
4. Switch the mains outlet **ON**.
5. Select required mode using front panel mode switch i.e. **Pure, Blend 1, Blend 2, Endocut** in cut mode or **Spray, Fulgurate, Desiccate** in coag mode

➤ **CUT MODE 4MODES**

- **PURE CUT** – maximum setting limit is up to 400. Press up down key to set the reading.
- **BLEND 1** – maximum setting limit is up to 250. Press up down key set the reading.
- **BLEND 2** – MAXIMUM setting limit is up to 200. Press up down key set the reading.
- **ENDOCUT** – maximum setting limit is up to 99 Press up down key set the reading.
- Press cut foot switch or hand switch for desired operation. by pressing footswitch or hand switch cut indicator illuminate yellow and audio speaker will activate.

➤ **COAG MODE 4 MODES**

- **SPRAY** - maximum setting limit is up to 120. Press up down key to set the reading.
- **FORCE**- maximum setting limit is up to 120. Press up down key to set the reading.
- **FULGURATE** - maximum setting limit is up to 150. Press up down key to set the reading.
- **DESICCATE** - maximum setting limit is up to 150. Press up down key to set the reading
- Press coag foot switch or hand switch for desired operation. by pressing footswitch or hand switch coag indicator illuminate blue and audio sound will activate.

➤ **BIPOLAR MODE 4 MODE**

- **MICRO** – maximum setting limit is up to 80. Press up down key set to the reading.
- **MACRO** - maximum setting limit is up to 80. Press up down key to set the reading.
- **CUT** - maximum setting limit is up to 100. Press up down key to set the reading.
- **AUTO**– maximum setting limit is up to 100. Press up down key to set the reading.
- Press bipolar foot switch for desired operation. by pressing footswitch bipolar indicator illuminate blue and audio sound will activate.

➤ **99 PROG. MODE**

- User settable program mode with first 3-prog mode previous settings can be store. Press up/dn key to set the reading. Press foot switch for desired operation
- Press cut or coag foot switch or hand switch for desired operation.



HOW TO USE MONOPOLAR DURING OPEN SURGERY:

1. CUTTING:

A high-frequency alternating current yields smooth, rapid cuts that evoke little to no hemostasis. The current stimulates cells to swell and explode. Cutting setting should be use of between **90 to 150** and press cut footswitch or hand switch. During cutting it is essential to press **CUT** footswitch before touching the tissue and maintain the spark at the tissue.

2. BLEND 1:

Preset blended cut modes give the surgeon varying degrees of hemostasis in cut mode. Adjust cut setting at **75 to 125**. Press CUT foot switch to Desiccate at **75 to 125**. Press CUT foot switch to Desiccate the tissue. It is recommended to touch the electrode to the tissue (**ARTERY FORCEP**) and then press CUT footswitch to avoid the sparking at the tissue.

3. BLEND 2:

The mode is used for the vaporization of prostatic tissue or any fat tissue. The higher output wattage gives fast cutting effect of the tissue.

3. ENDOCUT :

Endocut is used to automatically control cut system to reduce the complication rate of endoscopic sphincterotomy (EST) and serum hyperamylasemia after EST compared to the conventional blended cut mode.

5. SPRAY:

Spray output is made for direct coagulation at the tissue with spark. Above spark does not give any cutting effect as its **CREST FACTOR** is as high as **84**. (Crest Factor means ability to coagulate the tissue without cutting effect). During Spray it is essential to press (activate the Coagulation) **COAG** footswitch before touching the tissue and maintain the spark at the tissue.

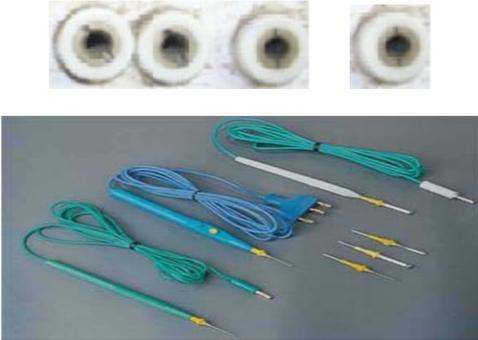
6. FULGURATE:

Sparking the tissue to lead to coagulation. There is no tissue-electrode contact; rather, voltage is raised in order to incite a spark between electrodes in order to coagulate the tissue in between.

7. DESICCATE (FORCED):

The drying out of cells leading to coagulation. Stems from direct contact with the active electrode and leaves a soft brown eschar, or scab. It ensures pinpoint desiccation with less destruction of peripheral tissue. This operating mode covers all the demands of standard coagulation. The surgeon can work quickly effectively either directly with the coagulation electrode or indirectly e.g. with a **surgical clamp**.

3.5 ACCESSORIES

PHOTOGRAPHS	DESCRIPTION
	<p>MONOPOLAR & BIPOLAR FOOT SWITCH</p> <p>The 4-pin connector is use to attach Monopolar footswitch In Monopolar foot switch there are two functional switch</p> <ol style="list-style-type: none"> 1) CUT 2) COAG <p>The 3-pin connector is use to attach bipolar footswitch.</p>
	<p>PATIENT PLATE</p> <p>This 2-pin receptable accepts the patient return electrode connector used in Monopolar procedures.</p> <p>Plate 3½" x 6" (8.9cm x 15.2cm) with 8' (2.4m) cord</p>
	<p>ELECTROSURGICAL HAND SWITCH PENCIL & MONOPOLAR ACTIVE</p> <p>Monopolar Active Receptable (Hand Switch) - This receptable will accept the 3 - pin hand switching active accessories.</p> <p>Monopolar Active Receptable (Accessory) - This receptable has single output jack.</p>
	<p>AUTOCLAVABLE BIPOLAR FORCEPS</p> <p>Bipolar Active Receptable - This receptable will accept 2 - pin bipolar accessories.</p>

3.6 ELECTRO SURGICAL TECHNIQUES

The electro surgical techniques are divided in two classes

Monopolar techniques and bipolar techniques

In Monopolar procedure, the electric current flux of the active electrode passes through the patient body going until the return electrode. In bipolar procedures, the radio frequency was flow from an active electrode to another active electrode through a limited amount of tissue between the two electrodes.

Modern electro surgical equipment produces a radio frequency wave of a very high frequency that reaches between **350000 cps (Cycles / Second or 350 KiloHertz)** and **400000 cps (4 MHz)**. The wave used in electro surgeries is in the mean of the frequency used in the FM Radio, and thus, electro surgical waves are frequently called Radio frequency waves.

- **Monopolar Surgical Generators**

There are **two surgical effects**, which can be achieved with electro surgery.

- a. **Electro Surgical cutting**

- b. **Electro Surgical coagulation**

- a) **electro surgical cutting – electric sparking to tissue with the cutting effect :**

In electro surgical cutting the objective is to heat the tissue cells so rapidly that the explode into steam leaving a cavity in the cell matrix. The heat is dissipated in the steam and therefore it does not conduct through the tissue to dry out adjacent cells. When the electrode is moved and fresh tissue is contacted new cells are exploded and incision is made. A true electro surgical cutting evolves sparking to tissue.

- b) **Electro Surgical coagulation (desiccation) – Low Power Coagulation without sparking**

In desiccation the current is passed through the electrical resistance of the tissue and the heat arises in the tissue. When the tissue becomes hot the water is slowly driven out of the tissue and hence the name desiccation. One can see that the tissue turns light brown co lour, then it stames and bubbles as the water is driven out. Desiccation takes place with the active electrode in good contact with the tissue.

- c) **Electro surgical coagulation (fulguration) – electric sparking to tissue without significant cutting:**

Fulguration can be defined as sparking to tissue with extremely high current density. In general, fulguration is always more efficient at producing necrosis and it requires only $\frac{1}{5}$ of average current flow of desiccation. In Fulguration mode sparks will jump to the nearest moist tissue as long as voltage is high enough to make a spark.

- **Bipolar Surgical generator**

Bipolar high frequency surgical technique has been widely accepted by Neuro Surgery, Laproscopy and general surgery in which desiccation is performed with Forceps or other biterminal electrodes.

The bipolar instruments has **two basic advantages** over the conventional Monopolar electrode.

The first, the patient plate is not used and thus one of the most common Sources of accidents are entirely eliminated. Second, the local nature of current flow means that the desiccation is extremely Localized. In Neurosurgery, desiccation is commonly done with very fine Forceps.

The advantage of the bipolar forceps is that the minimum of neural tissue is necrotized because the desiccation does not radiate away from the electrodes the way it does with the Monopolar forceps.

Bipolar procedures require an isolated output. If a grounded generator output is used and the patient's body happens to be grounded, only the electrode attached to the "Active" terminal will appear to work. The electrode attached to "patient" terminal will appear no more active than if it were made of wood. When the majority of the current is returning via some distant grounded place on the patient's body, the coagulation of the tissue will tend to spread radially away from the active electrode, just as it does with a Monopolar electrode. In true bipolar operation, only the tissue, which is grasped between the two electrodes, is desiccated. If the coagulation spreads more than about a millimeter from the direct path between the two electrodes, current is returning to ground through some grounded contact point on the patient's skin or at best it is leaving the patient's body via capacitance to ground. There are two types of Bipolar Coagulations.

A) SOFT Coagulation : Gentle to tissue and accessories :

Soft coagulation lets you treat tissues both gently and effectively. The total absence of carbonization keeps necrosis a minimum, with beneficial results for the postoperative healing period. Tissue adhesion to the electrode is greatly reduced. Instruments are subject to less soiling, with fewer interruptions of surgery for cleaning instruments and accessories have a longer service life. By selecting a low output, the surgeon can follow the progress of the tissue coagulation millimeter by millimeter. This permits fast, precise Monopolar and bipolar work even in microscopically small structures.

B) FORCE Coagulation : For situations where speed is essential :

This operating mode covers all the demands of standard coagulation. The surgeon can work quickly and effectively, either, directly with coagulation electrode or indirectly, e.g. with a surgical clamp.

3.7 SMART 4 PLUS PERFORMANCE RELATED TO SURGICAL SPECIALITY

<u>CARDIOTHORACIC – Cotonary Bypass</u>		<u>Standard Settings</u>
• Coagulation	————	35 watts
• Coagulation – heart surface	————	15 watts
• Blend cutting	————	60 watts
UROLOGY TURP, BLADDER TUMER		
• Pure Cut	————	90 watts
• Coagulation (fulgurate)	————	50 watts
• Coagulation to bladder neck	————	20-25 watts
• Blend cut for bladder tumors	————	90 watts
• Coagulation for bladder tumors	————	40 watts
NEUROSURGERY – Craniotomy, AVM, Aneurysm		
• Standard Bipolar: Desiccation	————	40 watts
• Standard Bipolar: Desiccation (Under magnification)	————	15 watts
• Cut/Blend	————	40 watts
• Coag	————	15 watts
ENT-T&A's		
• Coagulation	————	30 watts
GYN – Tuboligations		
• Blend cut	————	40 watts
• Coagulation	————	35 watts
• Standard Bipolar	————	45 watts
TUBOPLASTY		
• Blend	————	35 watts

- Coag _____ 20 watts
- Bipolar under magnification _____ 15 watts

GASTROINTIONAL ENDOSCOPY - POLYPECTOMY

- Coag _____ 35 watts
- Blend _____ 40 watts

papillotomy / sphinctrotomy

- Blend _____ 40-45 watts

GENERAL SURGERY - GALL BLADDER

- Pure Cut _____ 90 watts

Fulgurate Liver Bed

- Coag _____ 40 watts

Breast Biopsy

- Coag (spray) _____ 35 watts

Miscellaneous

- Coag _____ 35 watts
- Blend _____ 80 watts

Orthopedics (Lateral Release)

- Coag _____ 35 watts
- Blend (meniscectomy surgery) _____ 40 watts
- Coag _____ 35 watts
- Blend (miscellaneous) _____ 40 watts
- Coag _____ 35 watts
- Blend (meniscectomy surgery) _____ 40 watts

4. MAINTENANCE



4.1 ELECTROSURGICAL SAFETY TIPS

Prior to use : (General)

1. Know which E.S.U. will be used and how to use it. Consult the instruction Manual.
2. Have all equipment and accessories available and use only accessories designed and approved for the unit.
3. Check the operation of the alarm systems. If applicable, check the operation of the return cable sentry prior to placement of the return electrodes.
4. Replace all broken, bent, excessively scratched or otherwise damaged return electrodes.
5. Do not cut, crease or sharply bend a disposable return electrode.
6. Avoid the use of flammable anesthetics. (A warning to this effect should be evident on the E.S.U. cover).
7. Always place E.C.G. electrodes as far away from the site of surgery as possible.
8. Do not use needle E.C.G. electrodes.
9. Replace non-insulated instruments with updated equipment.
10. Check the line cord and plug on the E.S.U. extension cords should not be used.
11. Do not use any power or accessory cord that is broken, cracked, frayed or taped.
12. Use a conductive gel specifically designed for electro surgery.
13. Have backup equipment available. (Patient Return Electrode Placement)
14. Always place the return electrode on the patient as close to the electro surgical site as possible. Avoid fatty, bony, hairy, heavily areas and bony protuberances.
15. Avoid placing the return electrode where fluids may pool.
16. Do not slide the return electrode under the patient. The patient should be lifted and placed on the return electrode.

17. If the patient has a pacemaker, the return electrode should be as far from it as possible.

The use of fully working accessories



Before use, all accessories should be carefully checked for visible signs of damage and defects. All accessories must be subjected to regular technical checks, just as for main equipment. Defective and damaged accessories must, without fail, be taken out of service. The safety aspects of combining electrocautery equipment and accessories from different manufacturers must be checked before use by someone competent to do so (e.g. manufacturer, test department). A certificate must be issued. Suitable and tested accessories for a electrocautery instrument are usually listed in the operating instructions for the equipment or in an accessory data specification applicable to the system.

- **During Use:**

1. Use the lowest possible power setting to achieve the desired surgical effect. The need for abnormally high settings indicates something is wrong.
2. Position cords so that they present no tripping hazard. Do not wheel equipment over electrical cords.
3. If the patient is moved or repositioned, check that the return electrode is still in good contact with the patient. (If using an adhesive electrode, make sure the gelled area is in good contact, not just the adhesive border.)
4. When active accessory is not in use, remove it from the surgical field and contact with the patient. (With most of today's generators, all outputs are "hot" when one is activated.)

5. Do not coil up active or patient cables – this will increase R.F leakage current and present a potential danger to the patient.
 6. Do not spark the active electrode to ground to confirm operation of the unit. This may damage the unit or introduce a patient hazard.
 7. Do not active the electro surgical unit for long lengths of time.
 8. Avoid “buzzing” forceps and creating a metal-to-metal arc. Touch the forceps with the electrodes and then activate the generator. (This will eliminate the majority of “jolts” to the surgeon.
 9. Only use endoscopes with insulated eyepieces.
 10. Keep active electrodes clean. Escher build-up will increase resistance,
Reduce performance and require higher power settings.
 11. Do not submerge the active accessory in liquids. This may cause the accessory to activate.
- **After use:**
 1. Turn the unit off.
 2. Disconnect all cords by grasping the plug, not the cord, disconnect the power supply cord first.
 3. Coil electrical cord when sorting; don't bend or kink them.
 4. Do not reuse disposable accessory.
 5. Routinely replace all “permanent” cable at appropriate intervals – every three four months, depending upon usage rate.
 6. Wash all reusable accessories with the damp cloth. Do not immerse or soak.
 7. E.T.O. sterilized accessories if possible this will prolong their life.

● **INSTRUCTION REGARDING THE APPLICATION OF THE PATIENT PLATE**

1. The patient plate including cable and plug must always be in perfect condition. Above all, care should be taken to ensure that the surface of any reusable patient plate is clean and metallically bright.
2. Careful consideration should be given to the positioning of the electrodes and their connections. The high – frequency current path through the patient must be as short as possible. Therefore the patient plate should be positioned with its entire area covering the patient as close as possible to the operating area. The diagram shows the most suitable points of application on the upper arms or thighs for the appropriate operating areas.
3. Do not apply the neutral electrode to bony or hairy areas. Hairy areas should be shaved off before application.
4. The electrical conductivity of the skin in the area of the patient plate should be improved by cleaning away oil grease, massaging or brushing to improve the circulation and by carefully rubbing in saline solution.
5. Do not attach the patient plate directly over large blood vessels close to the skin. Attach the patient plate securely, so that even when the patient moves the whole fixture area is secure. Make sure that there is no excessive contusion, which could lead to necrosis resulting from lack of circulation.
6. Areas subject to considerable secretion of sweat, body extremities lying against the trunk or skin-to-skin contacts should be separated by the application of dry cloth. Drain of urine with a catheter.
7. During electro surgery, the patient must not come into contact with electrically conductive objects, such as the operating table supports, damps cloth etc. A thick, dry, electrically – insulating sheet must be placed between the patient, the operating table and the supports. During electro surgery, these sheets must not become damp.
8. If the patient is connected to a monitoring device during electro-surgery, the ECG electrodes should not be applied too close to the operating area. The distance should be at least 15cm. Instrument leads, which can conduct the RF current away from the patient, must not be applied to the patient during electro surgery.

Warning! In the floating mode the neutral ECG electrode must not be connected to the neutral surgical electrode, but should be placed as far as possible away from it.

9. The cable between the patient plate and the surgical unit must be as short as possible.

4.2 PREVENTIVE MAINTENANCE

- **Generators**

1. Do not use the top of the generator as a table. Fluids can enter the generator.
2. Keep the generator and foot switch clean. Use a damp cloth and mild detergent. Do not use solvents.
3. Coil the power cord when not in use.
4. Unplugged the power cord by grasping the plug, not the cord.
5. Have a qualified Biomedical Engineer inspect the unit at least every six month.
6. If a E.S.U. is dropped, it should not be used until inspected by Biomedical Engineer.

- **Accessories**

1. Establish procedures for cleaning and sterilization per manufactures recommendation.
2. Replace adopters that do not provide write connections.
3. Inspect "Permanent" cords and cables for clerks in insulations.
4. Rotate your stock of pre-gelled return electrodes according to lot numbers.

4.3 TROUBLESHOOTING

INCIDENT	Possible cause	Solution
ESU will not turn on	Disconnected or loose contact	Check connections and reconnect unit
Accessories is activated via handswitch or footswitch, but there is no ESU output	Malfunctioning instrument or accessories	Check all accessories and connections replace accessories if needed
	Incomplete or incorrect footswitch pedal connection	Reconnect footswitch pedal cable
	Possible internal malfunction	Inform technical service dept.
No tissue effect	Power setting is too low	Adjust power settings
No power audio and visual alarm	Internal malfunction	Inform technical service dept.
Abnormal neuromuscular stimulation (stop surgery immediately)	Demodulation due metal to metal arcing or sparking	Check all connection to the generator & accessories for loose fit or damage Ensure that the active
	Use of high voltage modes, such as spray or fulgurate	Use lower voltage modes such as desiccate or blend modes and lower settings, if possible
Continuous monitor interference with EKG and other vital sign monitors, i.e. EEG, Video, IV delievery systems, pulse oximeter	Faulty chassis to ground or loose connections	Check all monitor and ESU connection Re-connect or change outlets Use separate outlets for each medical device, if possible. Replace loose or damaged cords and adapters
Monitor interference occurs only when ESU is activated	Metal to metal sparking	Check all ESU, cord, adapter, instrument & monitor connections
	Cords and cables are bundled or touching, causing excessive current leakage.	Separate all cords: do not bundle for cord management Check all cords for compromised insulation Do not use any metal object for cord management
	Cord may be damaged	Replace any or all accessory cords
	Monitoring leads may be too close to electrosurgical instrument	Place monitoring equipment and leads as far away as possible from surgical site

DANGER : UNDER NO CIRCUMSTANCES SHOULD THE CASE OF THE SMART 4 PLUS OPENED EXCEPT BY QUALIFIED SERVICE PERSONEL. THERE IS POTENTIALLY HARMFUL VOLTAGE INSIDE THE CASE. NO USER SERVICEBLE PARTS INSIDE THE CASE.



5. WARRANTY CERTIFICATE

ESC MEDICAMS product is warranted to be free from electrical and mechanical defects in material and workmanship, under normal use. The product must not have been moved from the site of original installation. A new or remanufactured part to replace the defective part will be provided without charge for the part itself, through an authorized service dealer. The replacement part assumes the unused portion of the warranty.

We WILL NOT BE RESPONSIBLE FOR:

1. Damage or repairs required as a consequence of faulty installation or application by others.
2. Damage or repairs needed as a consequence of any misapplication, negligent handling, improper servicing, unauthorized alteration, or improper operations.
3. Failure to start due to voltage conditions, blown fuses, open circuit breakers or other damages due to the inadequacy or interruption of electrical service.
4. Damage as a result of floods, winds, fires, lightning, accidents, corrosive atmosphere, or other conditions beyond the control.

Date Of Installation	Installed By
Model No.	Serial No.
Warranty Period	
Name of Doctor & Address :	

Sign With Stamps