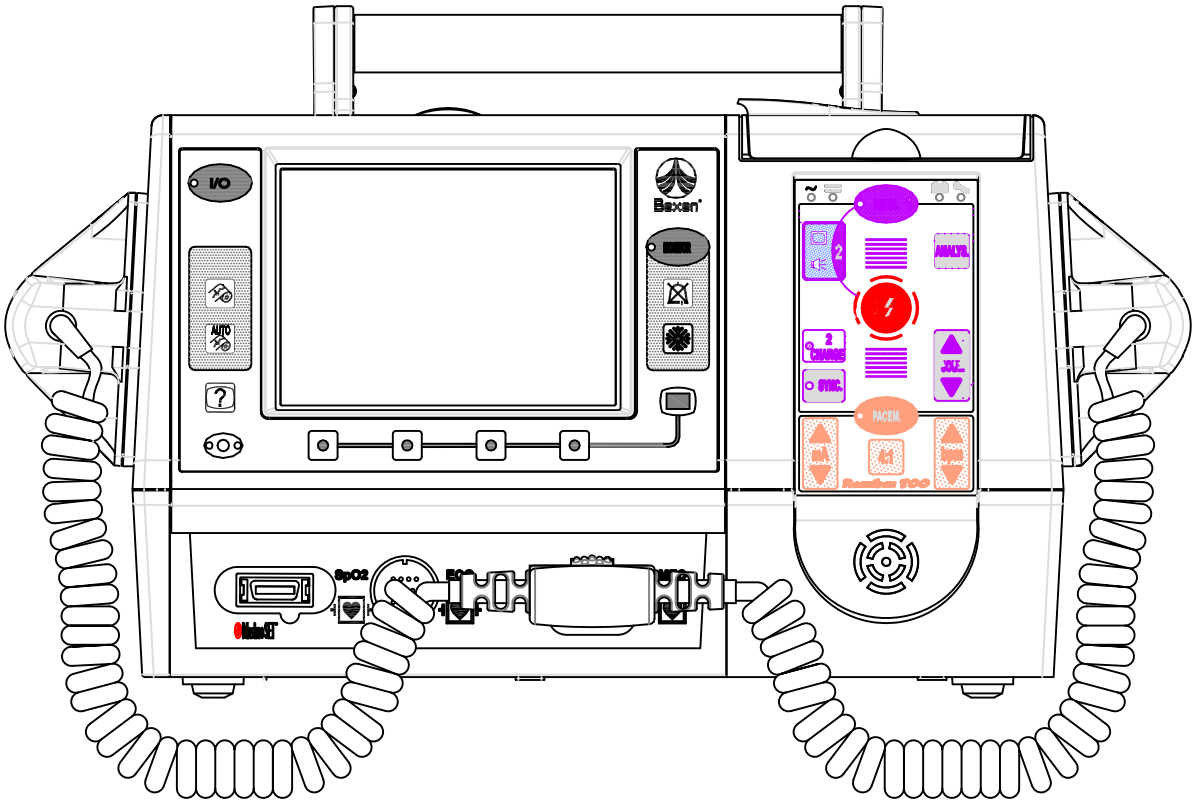
Bexen

Monitor Defibrillator

Reanibex 700



TECHNICAL MANUAL

DGG 700 B - Rev: H / 2011.DEC.

REANIBEX Serie 700

Technical Manual

Approved: R&D Director	**Revision**: H
	**Date:** December - 2011

Revision G 07/2011

REANIBEX Serie 700

This is a product of: **OSATU S.Coop**

Edificio Zearrekobuelta

Subida de Areitio Nº 5

48260 Ermua (Bizkaia) – SPAIN

Tlf : +34 943 17 02 20
Fax : +34 943 17 02 27

e-mail: osatu@osatu.com

www.osatu.com

CONTENTS

Blank page

1. Warnings

1.1 Safety

This symbol indicates the need to read the user's manual since pertinent information relating to the operation of the equipment is to be found in said manual.

Read the user manual carefully before using the unit

Keep the user manual next to the unit, in order to refer to it whenever necessary.

1.2 General

- The equipment must be used only by suitably qualified personnel.
- Remove clothing from the patient's chest, and, if necessary, dry the patient's chest and shave off excess hair in the areas where the paddles or electrodes, both for defibrillation and monitoring are to be placed. Avoid cutting the skin. Do not apply alcohol or any other substance to the patient's skin.
- Before defibrillating, remove any equipment connected to the patient that is not protected against defibrillation.
- Make sure that no one is in contact with the patient when defibrillating.
- The defibrillation electrodes must never be in open circuit or short circuit during the shock. They should be kept away from other electrodes or metallic parts that may be in contact with the patient.
- Avoid any contact between any part of the patient's body, such as the exposed skin of the head and limbs, and metal objects such as the bed or stretcher frame, that could cause undesirable deviation of the defibrillation current.
- Install the unit in a position not exposed to contact with water.

- Install the unit in a position where it is not negatively affected by atmospheric pressure, temperature, damp, ventilation, sunlight and air that contains particles dust, salt, sulphur components or other particles.
- The unit should be kept in a stable position, and any sudden movements, vibrations, blows or any other destabilising factor should be avoided.
- Do not touch, press or scratch the screen of the device with hard objects as they may damage it.
- Keep the apparatus clean. Clean with a damp cloth and a neutral detergent. Take account of the directions in this manual for cleaning of the different parts of the unit.

DANGER OF FIRE OR SHOCK: Do not submerge the unit or any part of the unit in water or other liquids. If the unit is accidentally submerged in water or other liquids, remove the battery until it is operative again.

DANGER OF FIRE OR SHOCK: Make sure accessories and all the equipment are correctly connected. Equipment or accessories not correctly interconnected can be a source of ignition, or cause shock.

CAUTION: The unit can be damaged by mechanical or physical misuse, such as immersion in water, or drops of more than 1 metre.

CAUTION: The components of the unit can be damaged if they are placed near sources of vibration.

WARNING: Risk of dangerous electrical shock or fire. Do not immerse either the unit or any part of it in water or any other liquid. Avoid spilling liquids on the unit or on its accessories. Do not clean the unit with inflammable agents such as acetones. Do not sterilize the equipment in autoclave nor in any other way.

WARNING: Dangerous electrical discharge. The equipment must be used only by authorized personnel, by a doctor or medical director, and that has minimal training in the following areas:

- ***Cardio-pulmonary resuscitation (CPR)***
- ***Use of a Monitor/Defibrillator in accordance with the recommendations of the American Heart Association - AHA or of the European Resuscitation Council - ERC***
- ***Use of the REANIBEX 700 Series***

WARNING: Risk of dangerous electrical shock. The defibrillator can provide up to 200 Joules of energy during a discharge. When the discharge is taking place do not touch either the patient or the defibrillation electrodes.

ATTENTION: During defibrillation avoid contact between parts of the patient's body (exposed skin of the head and limbs), and metallic objects such as the frame of the bed, which can produce undesirable paths for the defibrillation current.

WARNING: Air cavities formed between the defibrillation electrodes and the patient's skin can cause burns during defibrillation. Make sure that the defibrillation electrodes are perfectly adhered to the patient's skin. Once adhered, if the position of the electrodes must be changed, remove the electrodes and replace them with new ones.

WARNING: Do not allow the defibrillation electrodes or the paddles to touch each other, nor that they touch any part of a conductive material during defibrillation. Such contact can produce an electrical arch and burns to the patient's skin.

WARNING: Incorrect use of the equipment can result in injury. Follow the instructions of the User's Manual for its correct use.

DANGER: Possible danger of explosion if the equipment is used in the presence of concentrated oxygen or inflammable anaesthetic products.

ATTENTION: The use of cables, electrodes or batteries of other manufacturers can cause the unit to work incorrectly, and they invalidate the safety certifications. Use only the accessories specified in this manual and that have been supplied by OSATU S. Coop.

WARNING: The presence of radio frequency (RF) emitter sources near the equipment can cause its incorrect operation.

1.3 Design and Fabrication

The REANIBEX 200 unit meets the safety requirements laid down by the International ElectroTechnical Commission, and is classified as Class I, internally powered equipoment, type CF and continuous operating mode.

1.4 Preventive Maintenance

The aim of Preventative Maintenance is to ensure that the unit operates under safe working conditions, and prevent potential problems. Suitably qualified personnel should carry preventive Maintenance out at least once a year, only.

Make sure the unit is damage-free before using it. An immediate check should be carried out in the following cases:

- The unit has suffered serious mechanical stress, for example after being dropped.
- The unit has suffered serious mechanical stress, for example after a fall.
- Liquid has fallen onto the unit.
- Anomalous operation of the unit has been detected.
- Any connector or cables showing signs of deterioration.
- The reusable paddles show any sign of deterioration or are broken.
- The unit's malfunction indicator is blinking with a red color and on screen an error code appears.
- The unit's status indicator is red and on screen, when some of the operating modes are accessed, an error message appears.
- In the upper part of the screen one of the icons that indicates that an error has been detected in the unit's modules appears.
- The battery shows signs of deterioration.

1.5 Check list

The checks and tests that it is recommended to perform to ensure the correct operation of the device is listed below.

Serial number:	**Date:**
Operative:	**Signature:**

Procedure/Incident	Recommended action	Result
1. Visual inspection of the device		
• The device is dirty • There are cracks or damage	• Clean the device • Contact Technical service	
2. Visual inspection of accessories		
• Connectors, cables or paddles damaged or broken • Battery damaged or leaking • Battery discharged • Inspection of the recorder paper	• Contact Technical service • Replace the battery • Charge the battery • If there is no paper, replace the recorder paper	
3. Expiry dates		
• Monitoring or defibrillation electrodes expired • Monitoring or defibrillation electrodes opened	• Replace the expired electrodes • Replace the opened electrodes	
4. Supply		
• Connect the device to an external VAC source and check the indicator • Connect the device to an external VDC source and check the indicator	• If the indicator does not light up, contact Technical service • If the indicator does not light up, contact Technical service	
5. Integrity of the device		
• Run the test Hardware • Run the Accessories Test • Run the Front Panel Test • Run the Paddles Interface Test	• If any error exists contact Technical service • If any error exists contact Technical service • If any error exists contact Technical service • If any error exists contact Technical service	

1.6 Cleaning

To clean the REANIBEX Serie 700 device, the cables and the reusable external paddles the following considerations must be taken into account:

- Use a slightly damp soft cloth. Do not use abrasive or inflammable cleaning products.
- Do not immerse the device in liquids.
- Clean the device with the batteries installed to prevent the fluids from penetrating into the battery contacts.
- Use only the following products:
    - Isopropyl alcohol
    - Ammonia-based cleaning products
    - Common cleaning products
    - Hydrogen peroxide
    - Soapy water

WARNING: Do not immerse the device or any part of it in water or in any other fluid. Do not use abrasive or inflammable cleaning agents.

WARNING: Do not sterilize the REANIBEX Serie 700, or its accessories, in autoclave or with gas, unless it is specified to the contrary in the instructions for use of the accessory.

WARNING: Clean and dry well the reusable external paddles after every use. The defibrillation gel (damp or dry) accumulated both in the handles and in its containers can interfere in monitoring with the paddles and cause shock to the user.

If the quality of printing of the recorder is not adequate the recording head must be cleaned. For cleaning, perform the following steps:

1. Open the cover of the device under which the recorder is located
2. Open the door of the recorder pressing its safety catch
3. Extract the roll of paper.
4. Clean the printing head, above the brush, with cotton moistened in isopropyl alcohol.
5. Position the roll of paper again and close the door of the recorder and the cover of the device.

1.6.1 Sterilization of the internal paddles

In this section the steam sterilization process of the internal paddles is described. Continue the instructions provided when carrying out this process.

1. Clean the surface of the electrodes and the handles with a standard hospitable solution, such as, for example, isopropyl alcohol, using a soft cloth. Do not use acetone or ammonia-based cleaners.
2. Do not put the connector into the cleaning solution.
3. Before sterilization remove any excessive residue accumulated on the surface of the electrodes or on the handles.
4. Carry out the sterilization in a gravity sterilizer using the following parameters:
   - Sterilization temperature: 121 ºC
   - Duration of sterilization: 30 minutes
5. Protect the paddles before and after cleaning to avoid damaging their surface.

The shelf life of the internal paddles is affected by the number of sterilization cycles. The internal paddles supplied by OSATU have been proven to last almost for 50 steam sterilization cycles carried out with the previous parameters.

1.7 Storage

When the REANIBEX Serie 700 is not being used, follow the recommendations herein below for storage of the device:

- Store the REANIBEX Serie 700 with the NiMH battery pack installed at temperatures between 0 ºC and 40 ºC.
- Store the REANIBEX Serie 700 without the NiMH battery pack installed at temperatures between -20 ºC and 60 ºC.

If the device is operating outside of the recommended operating or storage temperature, the malfunction indicator located in the device front panel will remain switched on until the ambient temperature is within the stated range.

1.8 Explosions

This unit has not been designed to be explosion-proof, and therefore it must not be used in rooms or environments where there is a risk of explosion, nor in the presence of inflammable anaesthetic products nor concentrated oxygen.

FIRE OR EXPLOSION HAZARD: Do not use the unit when inflammable or anaesthetic gases are present.

1.9 Batteries

In this section the considerations to be taken into account for correct battery maintenance are explained, as well as the process for changing it. Good battery maintenance optimizes its duration, and guarantees that the that the device provides accurate indication about battery charge.

The REANIBEX Serie 700 uses high capacity rechargeable NiMH batteries that require minimal maintenance. The duration of a rechargeable NiMH battery depends on its frequency and use. When used and maintained correctly the useful life of the battery is 5 years or 500 charge/shock cycles.

Adequate maintenance of the battery implies taking the following considerations into account:

- Store the battery at temperatures less than 30 ºC and never expose the battery to high temperatures, greater than 40 ºC.
- Periodically carry out complete discharges of the battery (it is recommended once a month), for this purpose switching the device on without connecting it to any external power supply, until the battery condition indicator lights up with a red color.
- If the battery of the device is left out of it for a long period of time, and is stored at a temperature less than 30 ºC, recharge the battery every 6 months.

ATTENTION: Use only batteries supplied by OSATU or by its authorized distributors. The use of another battery type can cause the device not to operate correctly.

WARNING: Storage of the batteries at temperatures greater than 30 ºC significantly reduces their lifespan.

When it performs self-tests at start-up and during operation, the device checks the battery charge giving the appropriate instructions in case its charge is low.

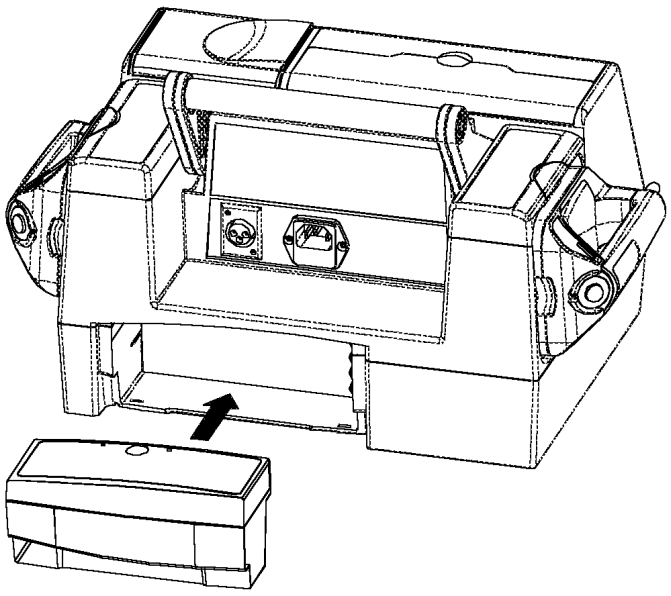
If on switching the device on, the battery indicator located on the front panel of the device is red in colour at start-up, it indicates that it is necessary to charge the battery, for this purpose connecting the device to an external power supply (car battery or AC mains).

WARNING: Danger of explosion. Do not recharge the REANIBEX Serie 700 batteries outside of the device, since they could explode.

Store the new battery packs at temperatures between 0 ºC and 35 ºC. The optimum temperature for storage of the batteries is 25 ºC.

When the battery is stored under ideal conditions, its capacity is equivalent to more than 130 discharges of 200 J, or more than 150 minutes of monitoring, or more than 120 minutes of monitoring plus pacemaker stimulation at 60 mA and 60 bpm.

Changing of the device external battery is shown in the following drawing:



When the batteries are installed in the equipment, and this in turn is connected to an external power supply (AC mains or car battery), the device continuously charges the battery, using an internal charger.

To extract the battery, pull upwards the battery retaining device (coloured black) and supporting it in this position extract the battery from its compartment.

If there is visible damage or if they become damaged, the NiMH batteries must be recycled. Follow the local, regional or national instructions of your country when recycling.

WARNING: Follow the local, regional or national instructions of your country when recycling the REANIBEX Serie 700 batteries, or send them to OSATU S. Coop.

WARNING: Danger of explosion. Do not try to open or to handle the battery. Do not incinerate the battery. Avoid electrical contact between the battery terminals.

1.10 Repairs and Inspection

OSATU S.Coop. can only accept liability for the safety aspects of the REANIBEX 700 when the maintenance, repairs and subsequent modifications have been carried out by our technical personnel or by companies authorised by us, and when components affecting the safety of the unit have been replaced with original spare parts.

The company reserves the right to carry out possible modifications without prior notice.

On request, OSATU S.Coop will provide circuit diagrams, component lists, descriptions, calibration instructions and other information that assist the suitably qualified technical personnel to repair those parts of the unit designated by the manufacturer as repairable.

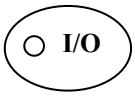
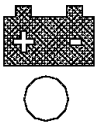
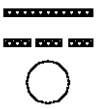
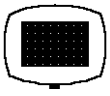
1.11 Recycling

- The REANIBEX Serie 700 must be cleaned and disinfected before being recycled. The device must be recycled in accordance with the recommendations of local, regional or national authorities of each country.
- The NiMH batteries once their useful life has finished, must be recycled in accordance with local, regional or national procedures of each country.

- The disposable defibrillation electrodes must be recycled in accordance with local, regional or national clinical procedures of each country.
- The device packaging must be been recycled in agreement with local, regional or national regulations of each country.

WARNING: Follow the local, regional or national instructions of your country when recycling the different parts of the REANIBEX Serie 700, or send them to OSATU S. Coop.

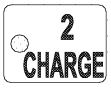
1.12 REANIBEX 700 Series Symbols

SYMBOL	MEANING
	**General ON/OFF button of the device**.
	**BATTERY STATUS indicator**
	**MALFUNCTION Indicator**
	**Indicates that the device is connected to an external ALTERNATING SUPPLY source (Vac)**
	**Indicates that the device is connected to an external DIRECT SUPPLY source (Vdc)**
	**RECORDER Activate/deactivate key**
	**Automatic RECORD key of all the LEADS**
	**EVENTS Key.**
	**MENU key**

FUNCTION Keys

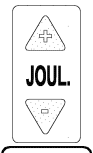
Alarms sound PAUSED key

On-screen signal FREEZE-HOLD key



Selected energy CHARGE key

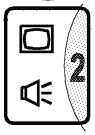
Synchronism ACTIVATION/DEACTIVATION key



ENERGY SELECTION keys

ECG signal ANALYSIS start key

DISCHARGE Button

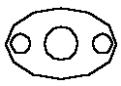


Icon for following the audible and visual instructions of the device when it is operating in Semi-Automatic Defibrillator mode.

Pacemaker stimulation CURRENT SELECTION keys

Pacemaker stimulation FREQUENCY SELECTION keys

Key for reducing the stimulation frequency by 4 (while it is being pressed)

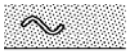


Microphone (Only for device with this option)

Equipotencial connection

10-16V
10 A

Connection of the direct external supply (car battery)



100-240 V
50-60 Hz
220 VA
2xT, 3Amp

Connection of the alternating external supply (AC mains)

Non-protected against defibrillation.
CF type device

Protected against defibrillation.
CF type device

ATTENTION: See accompanying documents

CE 0843

Symbol of certification in accordance with the Directive for medical devices 93/42/CEE

1.13 On-screen symbols

SYMBOL	MEANING
XX:XX:XX	**TIME PASSED since the device was switched on or real time (depends on configuration)**
140	**HEART RATE**
? 140	**LOW CONFIDENCE in the PULSE RATE obtained from the pulsioximeter**
- - -	**HEART RATE cannot be obtained**

Loose PATIENT CABLE LEAD

ERROR in the RECORDER (includes the lack of paper and the door being open)

QRS BEEP DEACTIVATED

ALARMS SOUND IN PAUSE

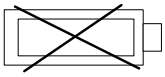
COMPACT FLASH FULL

ERROR in the COMPACT FLASH or no card installed

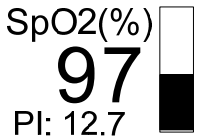
VT/VF ALARM ACTIVATED and analyzing ECG signal

NUMBER of SHOCKS supplied in Semi-Automatic Defibrillator mode

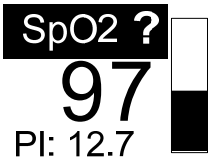
STATUS OF BATTERY CHARGE



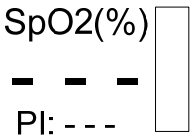
There is NO BATTERY INSTALLED in the device



SpO2%, signal intensity and perfusion index



LOW CONFIDENCE in shown SpO2 % value



SpO2% and PI can not be obtained

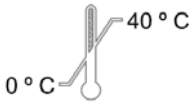
The SpO2 SENSOR is not CONNECTED to the patient

There is an error in the PULSE OXIMETRY module

TIME REMAINING for CPR

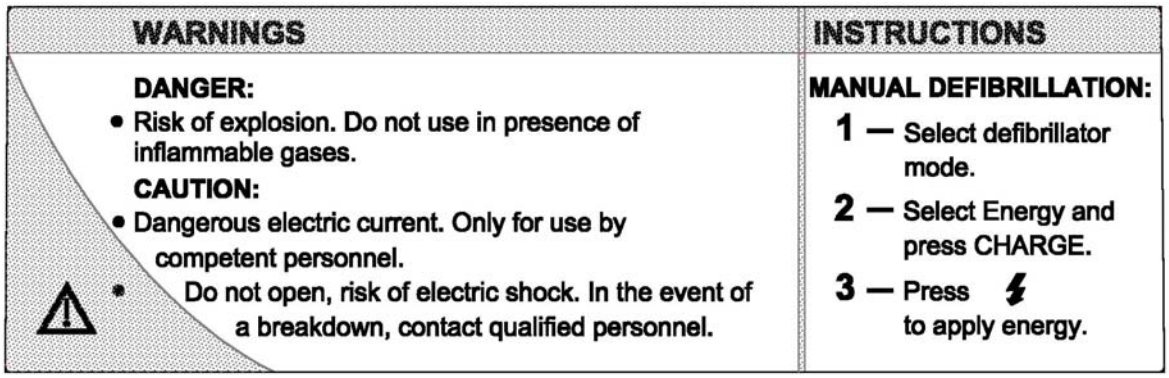
CHARGING the CAPACITOR to the selected energy

1.14 Battery symbols

SYMBOL	MEANING
	**ATTENTION: See accompanying documents**
	**Recyclable material. Heavy metal substances. Do not dispose them inappropriately**
	**Do not try to open the battery casing.**
	**Do not expose the battery to excessive heat or to flames. Do not incinerate the battery.**
LOT	**Batch of manufacture of the battery**
	**Date of manufacture of the battery**
	**Electrical and electronic equipment in accordance with Article 11(2) of Directive 2002/96/CE (WEEE)**
	**Rechargeable battery**
	**Battery operating temperature range**

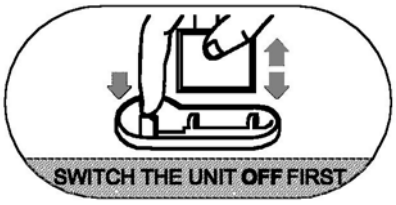
1.15 Unit labels

In the upper part of the device there is a label that contains a Serie 700 of warnings and precautions that it is necessary to follow when using the device, and the basic instructions for use of the device:



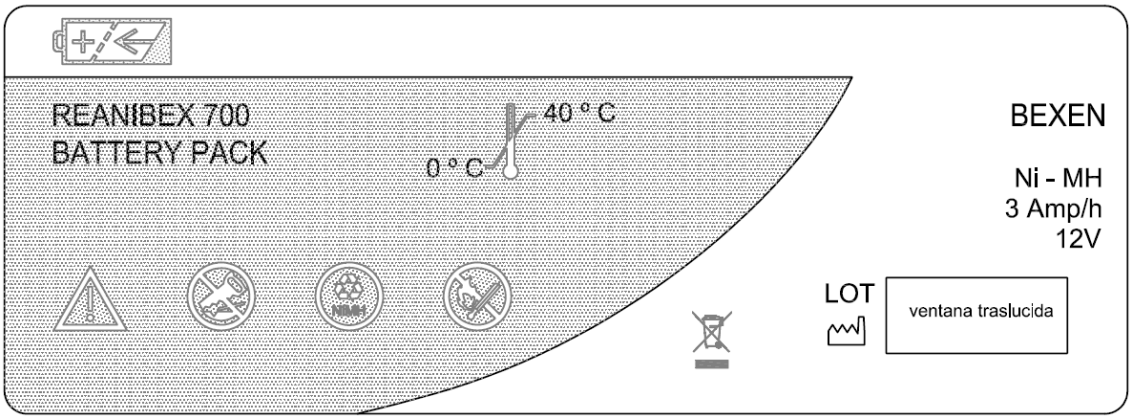
In the lower part of the device there is the following label, where the serial number of the device is shown.

In the upper part of the device, just under the protection cover of the Compact Flash, but only for those equipments which have Automated Defibrillation option, there is the following label that contains the indication of switching off the equipment before inserting and extracting the Compact Flash memory card:



1.16 Battery labels

The label included in the battery holds information relating to the battery characteristics (type, capacity, voltage, batch and date of manufacture), as well as recommendations for its handling and storage.



2. General description

The REANIBEX Serie 700 is a Monitor/Defibrillator which allows advanced monitoring and resuscitation functions to be performed, for this purpose having four modes of operation: Monitor with pulse oximetry (SpO2) option, Manual Defibrillator, Semi-Automatic (optional) Defibrillator and External transcutaneous (optional) Pacemaker. It is a portable and light piece of device, designed with the latest technologies in the field of the defibrillation such as the biphasic wave.

The device incorporates a wide screen that allows the viewing, not only of the ECG signal, but also of the monitoring parameters, both of the patient and of the device, information messages and user guide messages.

In Monitor mode the REANIBEX Serie 700 can pick up the signal via 3, 5 or 10 lead patient cable, from adult or paediatric external reusable paddles or from multifunction disposable electrodes.

In the Manual Defibrillator mode, if the patient needs a defibrillation shock this is simply applied by following three steps:

1- Select the energy
2- Charge
3- Shock

When operating in Semi-Automatic Defibrillator mode (optional) the REANIBEX Serie 700 analyzes the electrocardiogram (ECG) of the patient, and determines if the rhythm analyzed can be defibrillated, in which case it requires action on behalf of the user to provide the shock. During the whole process, the device displays on-screen text messages, and provides audible messages by means of a loudspeaker situated in its front part, that guides the user in his action, which makes the use of the device in this mode require minimal training.

The Pacemaker mode (optional) provides a non-invasive transcutaneous stimulation treatment providing the pulses via multifunction disposable electrodes.

The REANIBEX Serie 700 has a user-configurable high resolution recorder, which allows the printing of waveforms and of notes relating to the utilization.

In addition to this manner of operating with a patient, the REANIBEX Serie 700 has a special way of starting that provides access to the Configuration mode, from where setting and adapting

the parameters which control the operation of the device to the needs of the different users is permitted.

The REANIBEX Serie 700 can operate with NiMH rechargeable batteries, connected to a supply AC mains or connected to a car battery. The remaining battery capacity is constantly seen in the top part of the device screen. Likewise when the device is connected to an external power supply (AC mains or car battery) the battery is charged, by means of an internal charger, independently of whether the device is switched on or off.

At start-up and during the utilization, the REANIBEX Serie 700 carries out a number of self-tests that allow the detection of any malfunction or anomalous condition that may occur in it, and whose effect is that the device may not be safely used. Indication of error conditions that are detected is provided by means of an malfunction indicator located in the front part of the device and by means of on-screen error messages.

The device can also carry out various self-tests as requested by the user, using the Configuration mode options.

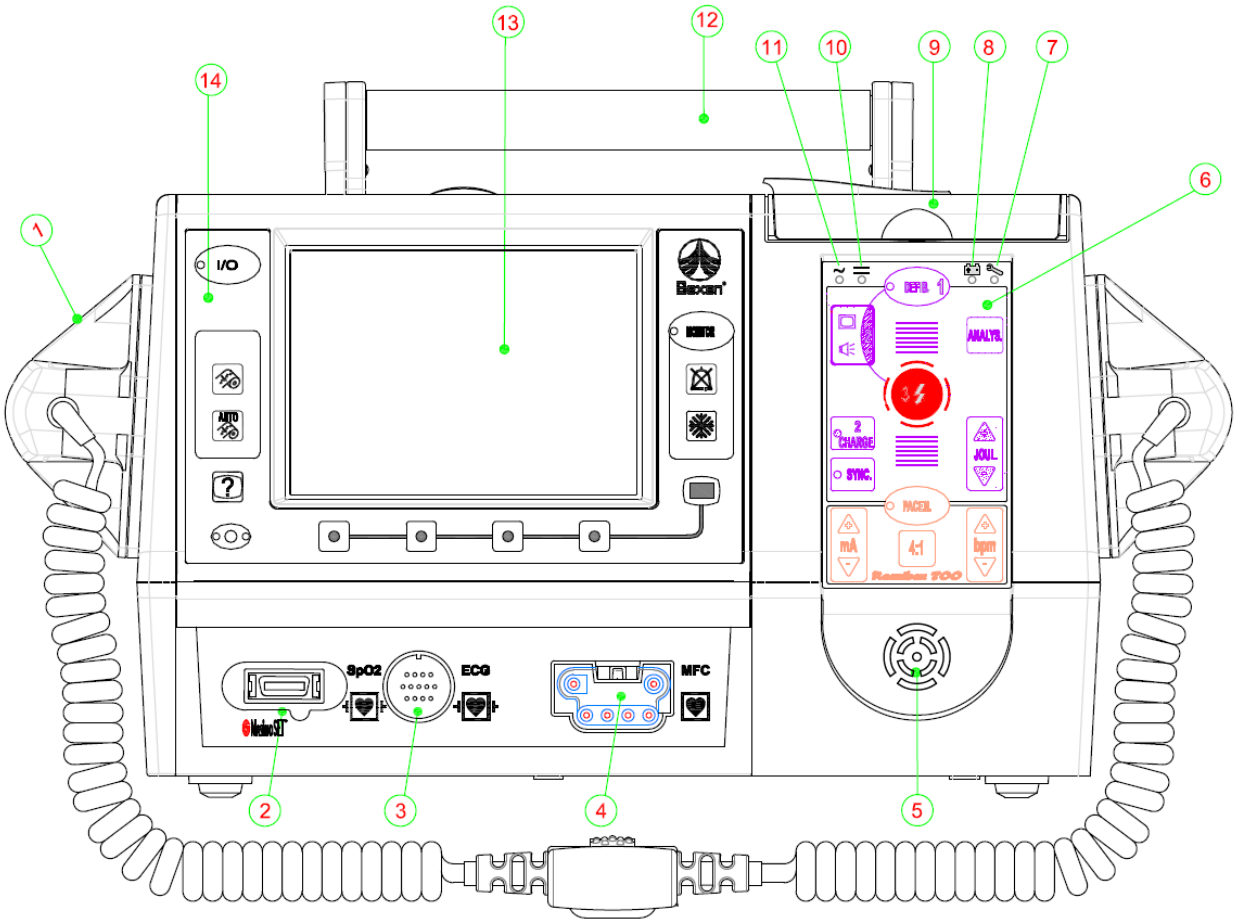
Finally, the REANIBEX Serie 700 has the option of automatically storing, in a Compact Flash type extractable external memory, information about the utilizations carried out with the device. This information includes the patient's ECG, the events that occurred during the utilization, and optionally, audio, both of the device and the ambient sound; provided always that the device is operating in Automatic Defibrillator mode. In addition to this information, they last 100 events / incidences that occurred during the utilization are stored, grouped according to the utilization to which they belong. All this information can be downloaded, visualized and stored using the "VISOR ECG CONTROL " program.

ATTENTION: Dangerous electrical shock. The device must be used only by qualified personnel, by a medical doctor or manager, and that has minimal training in the following areas:

- ***Cardiac-Pulmonary Resuscitation (CPR)***
- ***Use of a Monitor/Defibrillator in accordance with the recommendations of the American Heart Association (AHA) or of the European Resuscitation Council (ERC)***
- ***Using the REANIBEX Serie 700***

2.1 Front view

The elements and indicators that make up the front part of the device are described below:

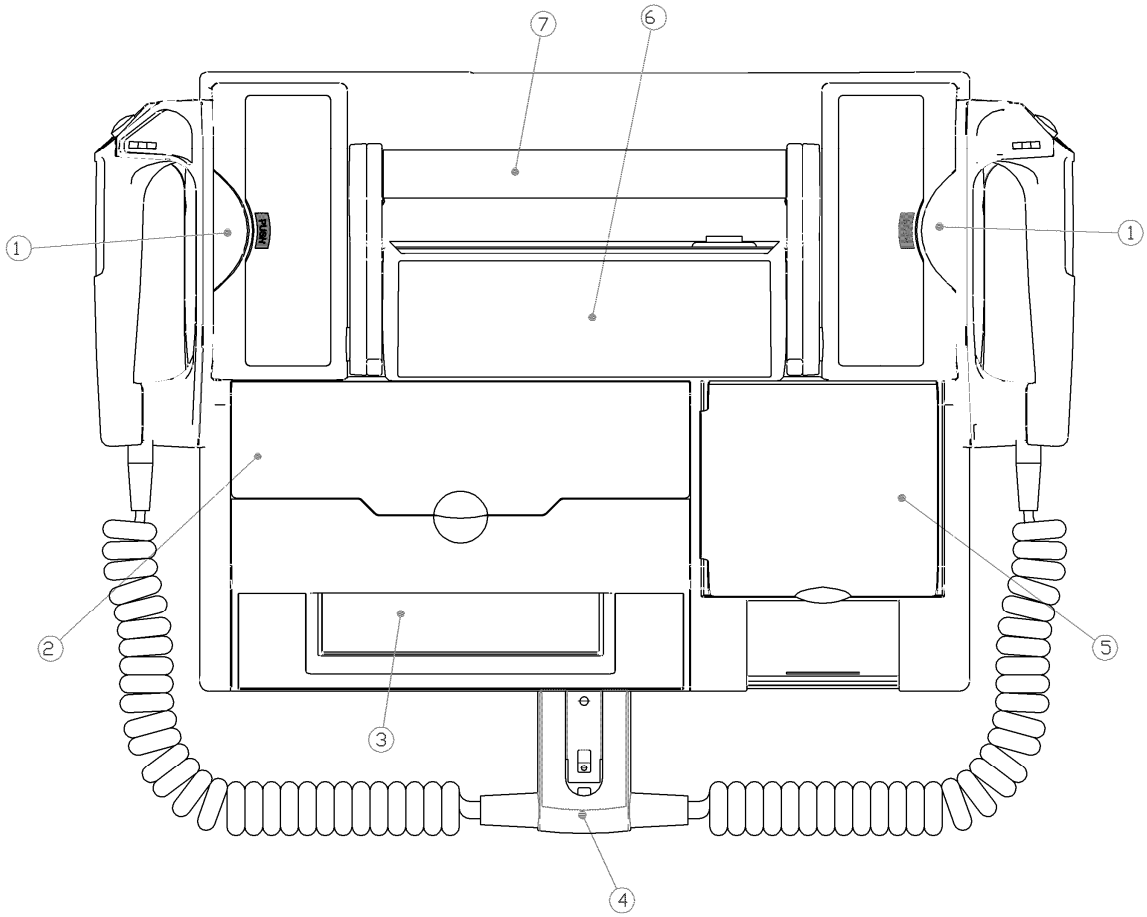


NUMBER	DESCRIPTION
1	**REUSABLE EXTERNAL PADDLES**
2	**PULSE OXIMETER** extension cable **CONNECTOR**; it allows the connection of the extension cable to which the pulse oximetry sensor is connected
3	**PATIENT CABLE CONNECTOR**, it allows the connection of the patient's cable, that can be 4, 5 or 10 lead
4	**MULTIFUNCTION CONNECTOR.** It allows the connection of the reusable external or internal paddles, and of the multifunction disposable electrodes.

5	The **LOUDSPEAKER** provides the sounds indicative of alarm, QRS detected, exceptional conditions produced during the utilization and also audible messages that guide the user during his utilization (Only for device that has the Semi-Automatic Defibrillator option).
6	**The FRONT PANEL,** that includes the activation keys of the different operating modes.
7	**MALFUNCTION INDICATOR.** It is illuminated when the device detects an error during any of the self-tests.
8	The **BATTERY STATUS INDICATOR** is an icon with a light. If this indicator light is green it means the battery is charging, while if it is red it indicates LOW BATTERY
9	**RECORDER** protection **COVER.** Under it the device recorder is located
10	**DIRECT CURRENT INDICATOR.** It indicates that the device is connected to a D.C. external supply source (car battery)
11	**ALTERNATING CURRENT INDICATOR.** It indicates that the device is connected to an A.C. external supply source (AC mains)
12	**CARRYING HANDLE.** This is a folding handle that allows simple means of transport of the device.
13	**Device SCREEN.** This is a graphic display of 320x240 points of resolution. The device has two types of optional screens: A high resolution TFT and a graphical LCD.
14	The **FRONT PANEL,** that includes the activation keys of the different operating modes, and keys common to all the operating modes.

2.2 Upper view

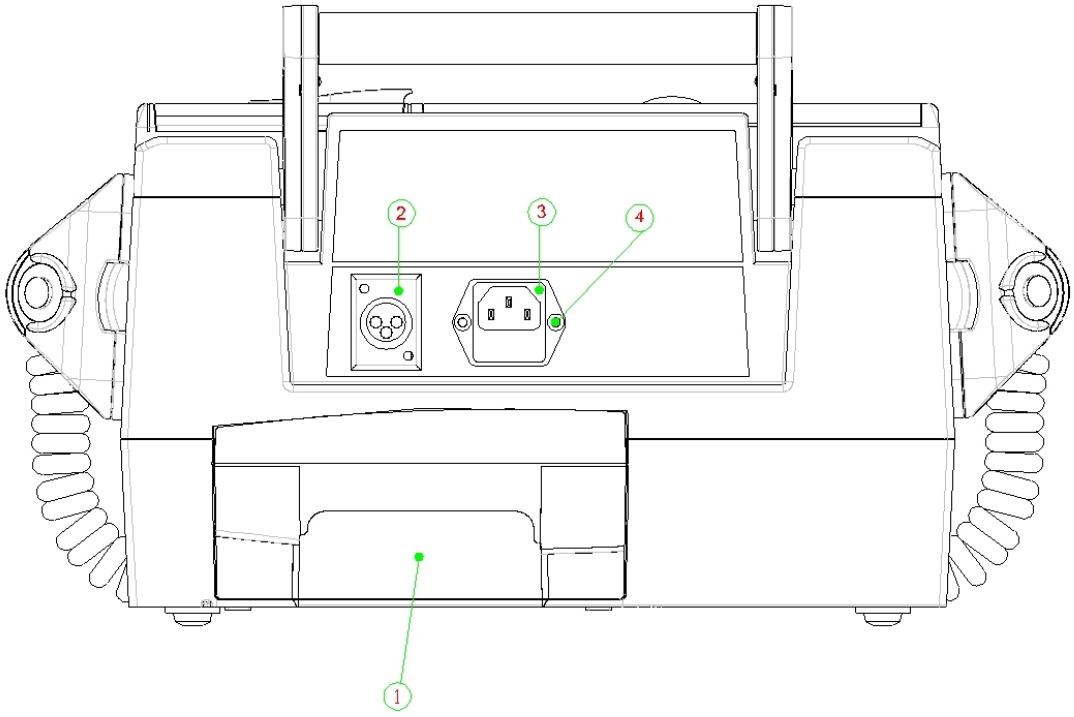
The items that can be seen in the top part of the REANIBEX Serie 700:



NUMBER	DESCRIPTION
1	**HOLDER** of the reusable external paddles**.** To release the paddles, press the holder and extract the paddles
2	**PROTECTION** cover of the **COMPACT FLASH** memory card. Under this cover the memory card holder is located. Only device that has the Semi-Automatic Defibrillator option has the possibility of data recording in the Compact Flash.
3	**DEVICE SCREEN**
4	**CONNECTOR** of the Reusable external Paddles.
5	**RECORDER** protection **COVER.**.
6	**BASIC INSTRUCTIONS** of use of the REANIBEX Serie 700.
7	**CARRYING HANDLE.** This is a folding handle that allows simple means of transport of the device.

2.3 Rear view

The rear part of the REANIBEX Serie 700 presents the following items:

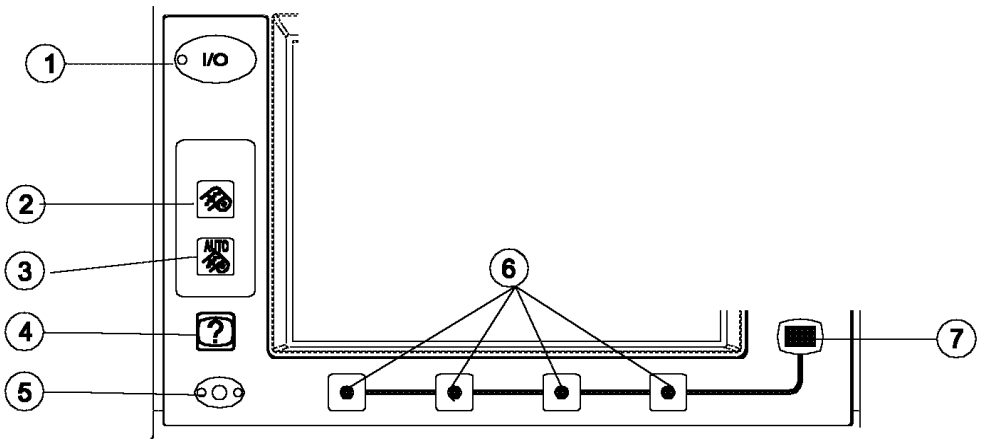


NUMBER	DESCRIPTION
1	**BATTERY HOUSING.** The place where the device battery is housed.
2	**CAR BATTERY CONNECTOR.** It allows the connection of the device to a D.C. external power supply
3	**AC MAINS CONNECTOR.** It allows the connection of the device to a A.C. external power supply
4	**EQUIPOTENCIAL CONDUCTOR.** It gives an additional conection for the earth conection of the building electric installation.

2.4 Front panel

In this section the functions associated with each of the keys available in the front panel are described. The different keys are grouped according to the mode to which they belong.

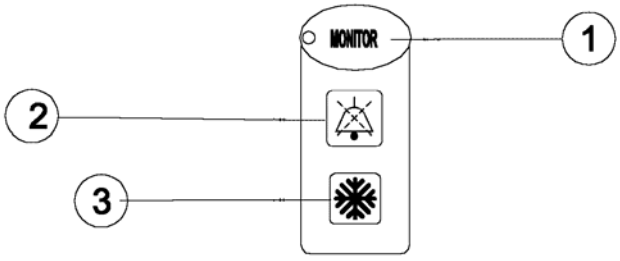
A series of keys common to all the ways of operation exists:



NUMBER	DESCRIPTION
1	**GREEN** general on/off **(I/O)** key of the device. The indicator of this key is illuminated when the device is switched on.
2	**RECORDER** start/stop key. For starting, and a record of both the ECG signal and the events occured during the utilization.
3	**AUTOMATIC RECORD** key of all the leads. It allows all the leads to be recorded depending on the available patient cable.
4	**EVENTS** Key. It allows an event from a predetermined list to be included in the utilization.
5	**MICROPHONE.** It allows the audio recording of the scene produced during the utilization (only for device that has this option and operating in Semi-Automatic Defibrillator mode)
6	**FUNCTION KEYS.** Their meaning change depending on mode of operation
7	**MENU** Key. It allows access to the different available configuration options in the different operating modes.

2.4.1 Monitor Mode

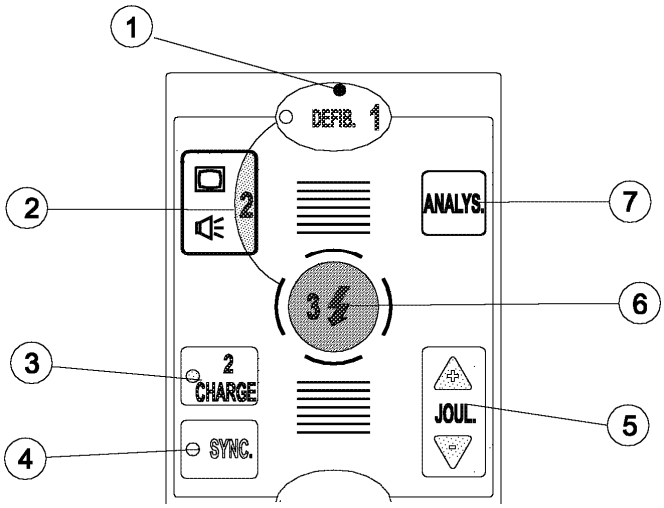
The keys corresponding to the Monitor mode are described below:



NUMBER	DESCRIPTION
1	**MONITOR** mode access key. The indicator of this key is illuminated when the device is operating in Monitor mode.
2	**ALARMS SOUND PAUSED** key. It allows sound alarms indication to be deactivated during a maximum time of 2 minutes. If a new alarm is generated while the sound of the alarms is in pause, a new sound indication will be generated.
3	**FREEZE-HOLD** Key. It allows the ECG signal on the screen to be frozen. While the signal is frozen, in the top part of the screen a small window appears with the evolution of the ECG signal with time.

2.4.2 Defibrillator Mode

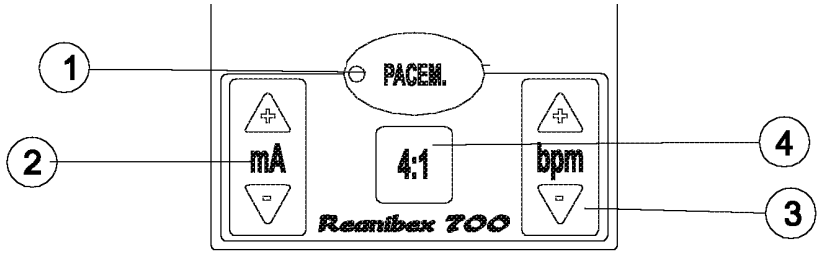
The keys that correspond with the Defibrillator mode of operation and that are located in the front panel of the device are:



NUMBER	DESCRIPTION
1	Access key for the **DEFIBRILLATOR** mode. The indicator of this key is illuminated when the device is operating in Defibrillator mode.
2	Indication for following the audible and visual instructions of the device when it operates in Semi-Automatic Defibrillator mode.
3	**Charge** the selected energy key. The indicator of this key illuminates when the energy has finished charging. It is only active in Manual Defibrillator mode.
4	**ACTIVATION/DEACTIVATION** of the **SYNCHRONIZED** shock key. When this option is active the indicator of this key is illuminated. This option is active only in Manual Defibrillator mode.
5	**ENERGY SELECTION** keys. They allow the selection of the level of energy to be discharged. This key is active only in Manual Defibrillator mode.
6	**SHOCK** button. This button illuminates when the device is ready to provide a shock, and allows the defibrillation shock to be given to the patient. It is only active when operating with multifunction disposable electrodes or internal paddles.
7	**ANALYSIS** Key. Allows access to the Semi-Automatic Defibrillator mode or to initiate an analysis during the CPR time. This key only appears in that device that has the Semi-Automatic Defibrillator option.

2.4.3 Pacemaker Mode (Optional)

The following keys located in the front panel of REANIBEX Serie 700 allow operation in the Pacemaker mode:



NUMBER	DESCRIPTION
1	**PACEMAKER** mode access key. The indicator of this key illuminates when the device is operating in Pacemaker mode.
2	**AMPLITUDE SELECTION** of the pacemaker stimulation pulses key
3	**FREQUENCY SELECTION** of the pacemaker stimulation pulses key
4	Key **4:1.** While this key is pressed the stimulation frequency of the pacemaker is divided by 4 to be able to observe the intrinsic rhythm of the patient.

2.5 Screen

The REANIBEX Serie 700 has a high resolution LCD type graphic display of 320x240 pixels (1/4 VGA) where both ECG signal and optionally the plethysmographic curve (SpO2), and the information relating to the patient monitoring parameters and to the state of the device are displayed. Optionally the device can have a wide vision angle EL type screen.

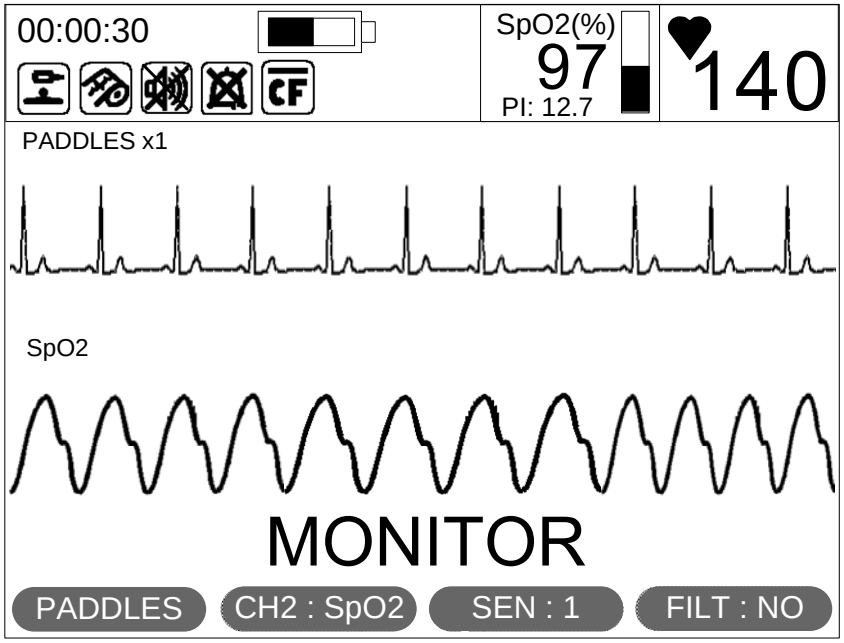
The device screen subdivides into three well differentiated parts:

1. ***Top part*** **-** Displays the operating parameters of the device (real time clock, information using icons of the state of the battery, state of the device, unhooked electrodes, cancellation of the alarms sound...),the numerical values of the monitoring parameters (Heart Rate and %SpO2), and the icons that indicate exceptional operating conditions (errors in the recorder, errors in the Compact Flash memory card).

2. ***Middle part – Displays the biological signals.*** It will be possible to display a single ECG channel or cascaded, or an ECG channel along with the plethysmographic curve, for device with this option.

   In the lower part of this area guide messages for the user, when in Semi-Automatic Defibrillator mode, and informative messages for the rest of the modes, are displayed.

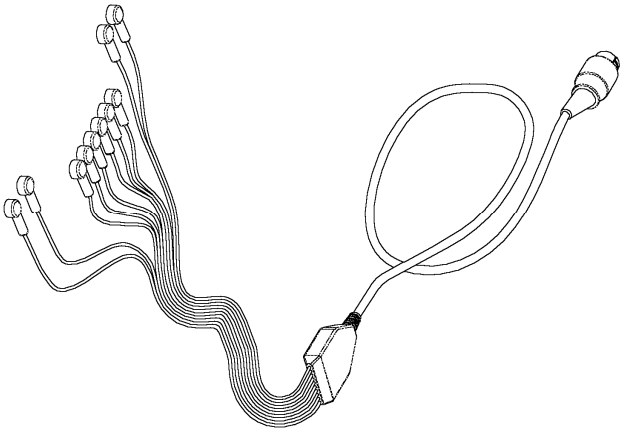
3. ***Lower part -*** Displays the meaning that is acquired by each of the function keys, that are located under the screen.



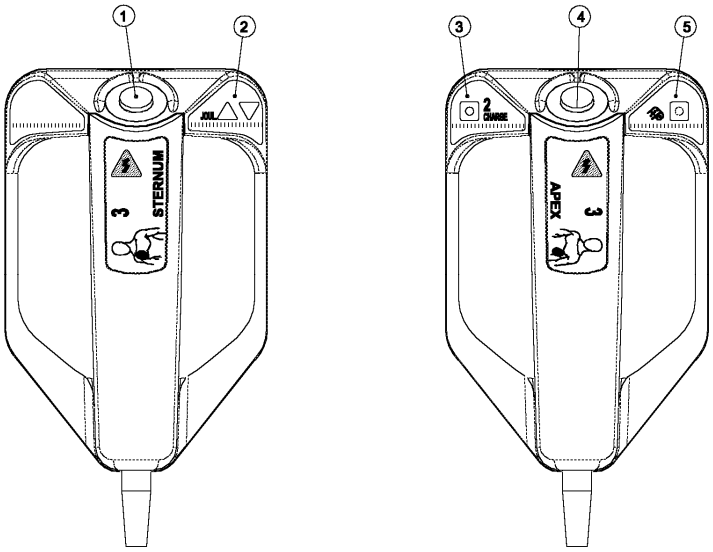
2.6 Paddles, electrodes and patient cable

For monitoring, the REANIBEX Serie 700 can use patient's cable, external or internal reusable paddles and multifunction disposable electrodes. For defibrillation, external or internal reusable paddles and multifunction disposable electrodes.

The patient cable that the device uses can be 3, 5 or 10 lead. The device automatically detects the type of cable connected allowing the viewing of the different leads.



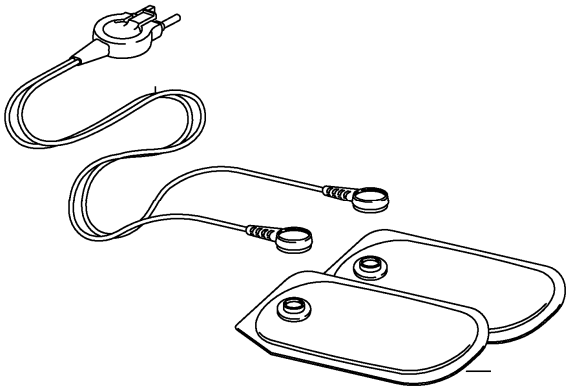
The external reusable paddles have keys for the selection and charging with energy, for printing, and two shock push buttons:



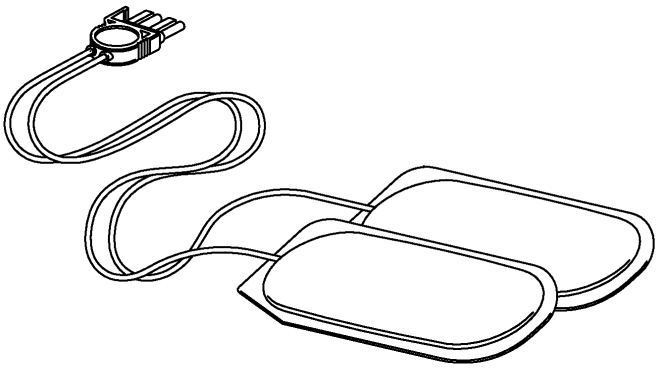
NUMBER	DESCRIPTION
1	**SHOCK** Push button of the Sternum pad. Operating in Manual Defibrillator mode allows the shock to be supplied to the patient when simultaneously pushed with that of the Apex pad.
2	**ENERGY SELECTION** Keys. They allow the level of the energy to be supplied, when operating in Manual Defibrillator mode, to be fixed.
3	**CHARGE** Key. Operating in Manual Defibrillator mode allows the charging of energy to be supplied

4	**SHOCK** Push button of the Apex pad. Operating in Manual Defibrillator mode allows the shock to be supplied to the patient when simultaneously pushed with that of the Sternum pad.
5	**PRINT** Key. It allows the recording both of the biological signals and of the events that occur with the device during the utilization.

The device can use two types of different multifunction disposable electrodes:



Permanent connector-cable with disposable electrodes



Disposable electrode-cables

Blank page

3. Technical specifications

3.1 General

TECHNICAL SPECIFICATIONS	
Electrical protection	Input protected against high voltage defibrillation pulses (IEC 60601)
Safety Classification	IEC 60601, type CF, class I, internally powered equipoment. Continuous operating mode.
MONITOR	
ECG	Monitoring is performed using 4, 5 and 10 lead cable, internal or external reusable paddles and disposable multifunction electrodes
Outputs	- 4 Lead cable: PADDLE, I, II, III , aVR, aVL y aVF. - 5 Lead cable: PADDLE, I, II, III aVR, aVL, aVF and V - 10 Lead cable: PADDLE, I, II, III aVR, aVL, aVF and V1 to V6
Loose lead indication	An icon appears on-screen when any lead is loose or badly connected. The amplitude of the current applied to the patient to detect a lead-off is less than 0.5 uA.
Size of the ECG	0.5, 1, 2 and 4 cm/mV selectionable from the front panel
On-screen speed of the ECG	25 mm/sec
Frequency response	- MAINS Filter: (50/60 Hz). - Diagnostic: 0.05-150 Hz (only on the recorder) - Muscle filter: 0.67-40 Hz (only on the recorder) - On-screen response: 00.5-25 Hz
Cardiac frequency	30-300 ppm ± 10 % shown on the unit screen
Heart rate meter accuracy and response to irregular rhythm	Meets the IEC 60601-2-27:2005 standard for ventricular bigeminy (HR=40 bpm).
Averaged heart rate	- For heart rates greater than or equal to 50 bpm, the 8 most recent R-R intervals are used for

	averagingthe heart rate - For heart rates lower than 50 bpm, the 4 most recent R-R intervals are used for averaging the heart rate.
Heart rate response time	- From 80 to 40 bpm: 3 secods - From 80 to 120 bpm: 2 secondss
Alarm response time for tachycardia	- 206 bpm (1 mV): 2 seconds - 206 bpm (half amplitude): 3 seconds - 206 bpm (double amplitude): 3 seconds - 195 bpm (2 mV): 2 seconds - 195 bpm (half amplitude): 2 seconds - 195 bpm (double amplitude): 2 seconds
Capacity to reject T-waves	Rejects T-waves with a maximum amplitude of 0.7 mV
Alarms	- Maximum and Minimum Cardiac frequency - Maximum and Minimum% SpO2 (only with the pulse oximetry option) - VT/VF Alarm (only with the Semiautomatic Defibrillator option)
Common mode rejection	> 100 dBs
Simultaneous use of the REANIBEX Serie 700 with other equipment connected to the patient	- The REANIBEX Serie 700 can be utilized simultaneously with an electrosurgical unit. A defect in the neutral electrode of the electrosurgical unit does not represent any safety risk for the patient since the device provides protection against high-frequency burns. This protection resides in the fact that the patient cable is electrically isolated through a ground connection. Consult the Instructions for Use for the electrosurgical unit to reduce the risk of burns in case of a defect in this device The simultaneous use of the REANIBEX Serie 700 with an external pacemaker and other electrical pacers connected to the patient do not represent any safety risk. The device could detect the internal pacemaker pulses as QRS complexes which results in an indication of an incorrect eart rate.
SpO2 Pulse oximetry (Optional)	

Saturation (% SpO_2) range	1-100%	
Saturation (%SpO_2) accuracy during no motion conditions	Adults/Peditrics	70% - 100 % : ± 2 digits
		0% - 69 % : Not especified
	Neonates	70% - 100 % : ± 3 digits
		0% - 69 % : Not especified
Saturation (%SpO_2) accuracy during motion conditions	Adults/Peditrics / Neonates	70% - 100 % : ± 3 digits
		0% - 69 % : Not especified
Saturación (% SpO_2) resolution	1%	
Pulse Rate Range (bpm)	25-240 bpm	
Pulse rate (ppm) accuracy during no motion conditions	± 2 bpm	
Pulse rate (ppm) accuracy during motion conditions	± 5 bpm	
Pulse rate (ppm) resolution	1 bpm	
DEFIBRILLATOR		
Waveform	Truncated exponential biphasic, with compensation of energy depending on the impedance of the patient	
Output Energy accuracy (over 50 Ω)	± 15 % or ± 3 j, whichever is greatest in the entire range	
Manual Defibrillator		
Output energy		
External paddles	1 - 2 - 3 - 5 - 7 - 9 - 10 - 15 - 20 - 30 - 50 - 70 - 100 - 125 - 150 - 200 Joules.	
Internal paddles	1 - 2 - 3 - 5 - 7 - 9 - 10 - 15 - 20 - 30 - 50 Joules	

Paddles Options	- Reusable external paddles - Internal paddles - Multifuctions ingle-use cable-electrodes - Permanent single-use multifunctions electode cable
Energy Selection	Front panel button and external paddle buttons
Charge Control	Front panel button and external paddle buttons
Charge Indicator	Charging tone, end of charge tone, LED in charge button and shock button on the front panel blinking for single-use multifunction electrodes and internal paddles
Shock Control	Buttons on the external paddles, front panel button for single-use multifunction electrodes and internal paddles
Charge time	- Less than 5 seconds at 200 J with a new and fully charged NiMH battery pack at 25ºC. - Less than 10 seconds without a battery pack and connected to a power voltage at 90-100 % of the nominal value. - Less than 10 seconds with a new and fully charged NiMH battery pack, depleted with 15 shocks at 200 J at 25ºC
Maximum time from the initial power supply connection until ready to shock status	- Less than 10 seconds from initial start-up with a new and fully charged NiMH battery pack. - Less than 15 seconds from initial start-up, without a battery pack, and connected to a power voltage at 90-100 % of the nominal value. - Less than 15 seconds with a new and fully charged NiMH battery pack, depleted with 15 shocks at 200 J at 25ºC.
Synchronization	Front panel button. On-screen indication of the synchronization points
Maximum time delay between the synchronization pulse and energy delivery	Energy delivery is carried out within 60 ms following the detection of a QRS peak. This time is measured using a calibrated defibrillator analyzer.

Semi-automatic defibrillator (Optional)	
Output energy	Maximum: 200 Joules ± 15 %
Paddles Options	- Single-use multifunction cable- electrodes - Permanent cable with disposable electrodes
Guide messages	Emission of audible and on-screen messages that guide the user during the procedure
Charge Indication	Charging tone, end of charging tone and blinking front panel discharge button
Discharge Control	Front panel button
Configuration of procedure parameters	By means of the corresponding options of the Configuration Mode
Detection Characteristics	- VF Sensitivity: Conforms to AHA - VT Sensitivity: Conforms to AHA - NSR Specificity: Conforms to AHA - Specificity of other signals: Conforms to AHA
Maximum time from the start of the rhythm analysis until ready status for shock	- Less than 20 seconds with a new and fully charged NiMH battery pack. - Less than 20 seconds without a battery pack and connected to a power voltage at 90-100 % of the nominal value. - Less than 20 seconds with a new and fully charged NiMH battery pack, depleted with 15 shocks at 200 J at 25ºC.
Maximum time from the initial supply connection until ready status for shock	- Less than 26 seconds with a new and fully charged NiMH battery pack. - Less than 26 seconds without a battery pack and connected to a power voltage at 90-100 % of the nominal value. - Less than 26 seconds with a new and fully charged NiMH battery pack, depleted with 15 shocks at 200 J at 25ºC.
PACEMAKER (Optional)	

Waveform	Continuous current rectilinear
Pulse width	40 msec
Amplitude	From 0 to 150 mA in increments of 5 mA
Frequency	From 30 to 180 ppm in increments of 5 ppm
Operating modes	- Fixed - On Demand
Refractory period	- 240 msec from 30 to 80 ppm - 340 msec from 85 to 180 ppm

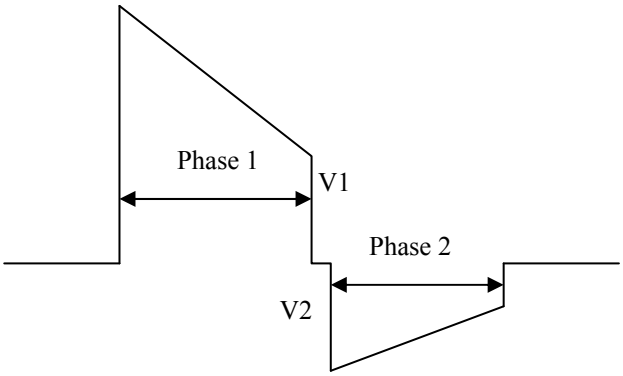
SCREEN	
Size	- 120 x 89 mm (SP14Q001- Hitachi) - 115.2 x 86.4 mm (EL320.240.36 HB -Planar)
Type	- LCD with backlight (SP14Q001- Hitachi) - High resolution EL (EL320.240.36 HB -Planar)
Resolution	320 x 240 pixels (1/4 VGA)
Sweep velocity	25 mm/sec
Wave visualization time	4.5 seconds
RECORDER(Optional)	
Continuous ECG strip	Prints a continuous strip with an ECG channel along with annotations and events. For units with the pulse oximetry option 2 channels can be printed: The ECG signal and the plethysmographic curve (SpO2)
Automatic Printing	It can be configured to automatically print the 8 seconds before and after alarm-tripping events and defibrillation discharge.
Reports	- Procedure report - Graph of Cardiac Frequency and % SpO2

	tendencies (optional) - Results of manual test and those carried out by the equipment. - Configuration parameters - Events / incidences stored in the memory card along with the associated ECG signal.
Width of Paper	50 mm
Speed	10, 25 and 50 mm/sec ± 5 %
DATA STORAGE (Optional)	
Type of Memory	Compact Flash withdrawable external memory
Capacity	Minimum 16 MB equivalent to 2 hours of continuous ECG plus audio
Data	- Continuous ECG plus audio (optional) - Significant events/incidents along with the associated ECG signal
GENERAL	
Indicators	- Battery status indicator - Unit malfunction indicator - Type of supply indicator - Charge indicator - Energy charged indicator - Synchronism indicator
Self-checks	- At start-up - During operation - Manuals on user demand
SUPPLY	
Battery	
Type	NiMH (rechargeable)
Capacity	- More than 120 discharges at 200 J - More than 150 minutes of monitoring - More than 120 minutes of monitoring plus pacemaker (60 mA and 60 ppm)

Charge time	Approximately 3 hours
Weight	800 grams
Alternating (Mains)	100-240 Vac and 50/60Hz
Direct (Car battery)	10-16 Vdc
Equipotential Conductor	It provides an additional connection to the ground connection of a building electrical installation. If this ground connection is not available, connect the equipotential conductor to any metal element accessible on the building structure.
ENVIRONMENTAL CONDITIONS	
Operating temperature	- 0ºC to 50ºC in Monitor mode and Defibrillator mode only, with installed battery pack and without any power supply connection - 0ºC to 40ºC connected to a power supply connection
Storage temperature	- -20ºC to 60ºC except for batteries and single-use multifunction electrodes
Relative humidity	10 to 95%
Resistance to water	IPX2
Vibration	IEC 60068-2-64
Discharge	IEC 60068-2-27
PHYSICAL CHARACTERISTICS	
Weight	- Device with recorder, reusable external paddles and battery: 6.9 Kg - Device with recorder, multifunction disposable electrodes and battery: 6.0 Kg - Device with recorder, SpO2 option, AED, pacemaker, multifunction disposable electrodes and battery: 6.3 Kg - Reusable external paddles: 0.95 Kg - Battery: 0.8 Kg
Dimensions	195 mm height x 249 mm length x 310 mm width

3.2 Defibrillation waveform

For defibrillation the REANIBEX Serie 700 has incorporated a BIPHASIC TRUNCATED EXPONENTIAL WAVEFORM:



Commutation time between phase 1 and phase 2 of the wave is 600 μsec. Furthermore, it is devised so that the negative tension (V2) coincides with the positive (V1) in the change of polarity.

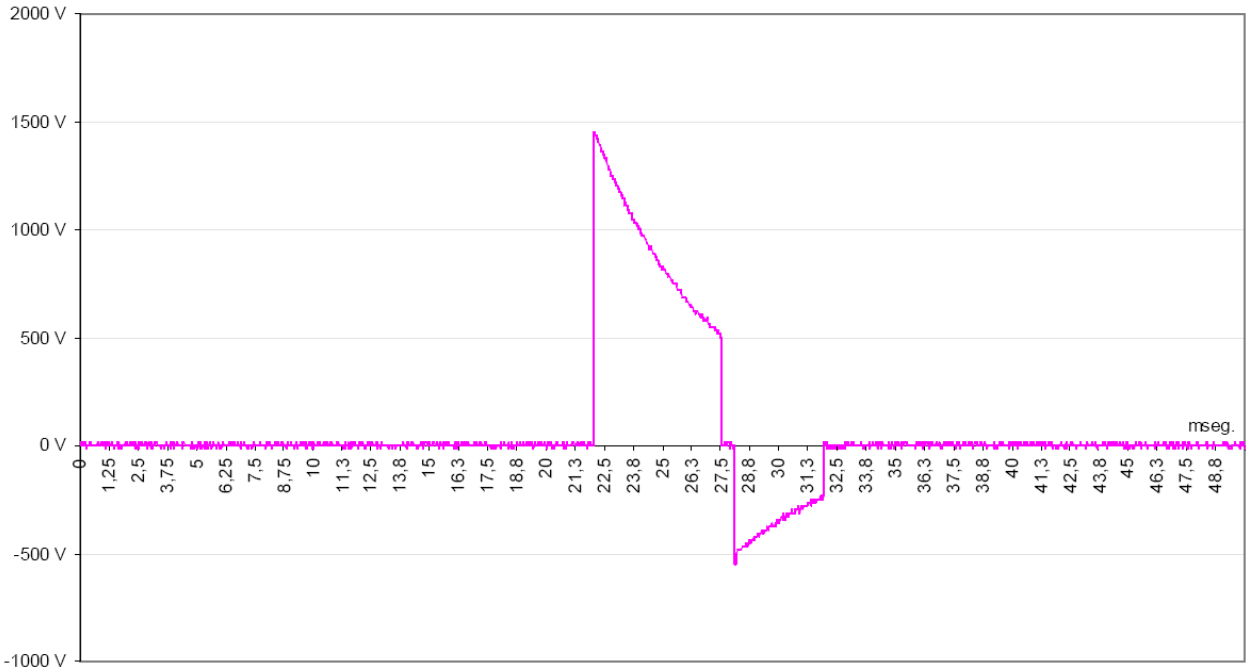
The energy supplied during both phases depends on the impedance of the patient, maximizing in this way the effectiveness of defibrillation.

The device provides shocks with impedances that vary between 20 and 300 Ω. If the impedance is less than 20 Ω it is assumed that a short circuit exists between the defibrillation electrodes. For impedance greater than 300 Ω it will be assumed that the electrodes are badly connected to the patient, or that there is no patient connected, emitting the corresponding messages.

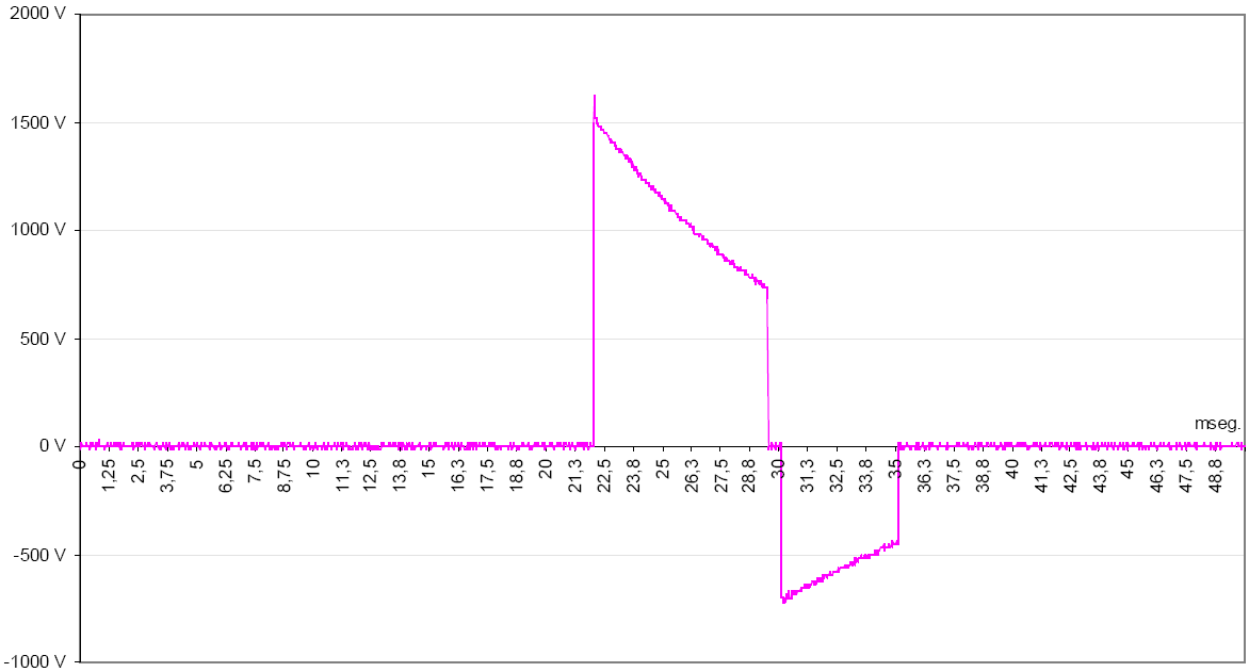
The energy supplied in each phase of the wave is dynamically adjusted based on the impedance of the patient:

Charge resistance (Ω)	Phase1 Duration (msec)		Phase2 Duration (msec)		Energy applied (J)
	Min	Max	Min	Max	
25	5.1	6.0	3.4	4.0	219
50	6.8	7.9	4.5	5.3	217
75	7.6	9.4	4.9	6.5	219
100	8.7	10.6	5.8	7.1	206
125	9.5	11.2	6.3	7.4	200
150	10.1	11.9	6.6	8.2	193
175	10.6	12.5	6.9	8.6	190

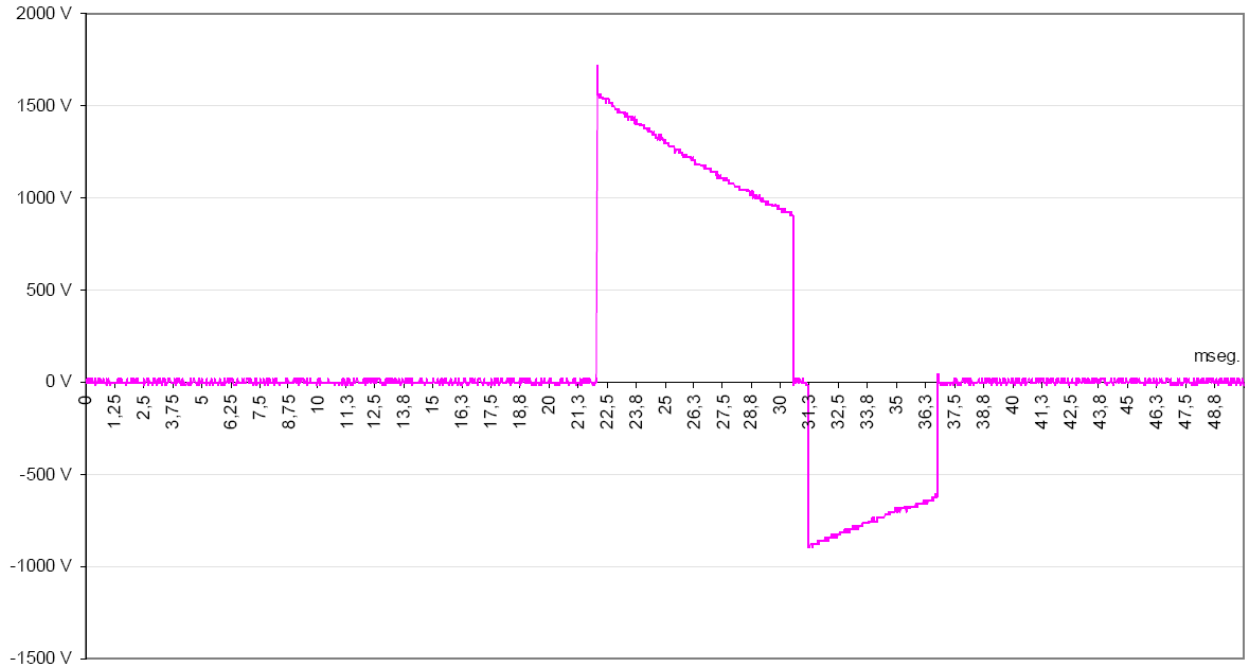
Discharged energy waveforms at differente patient impredance, for a selected energy of 200 J:



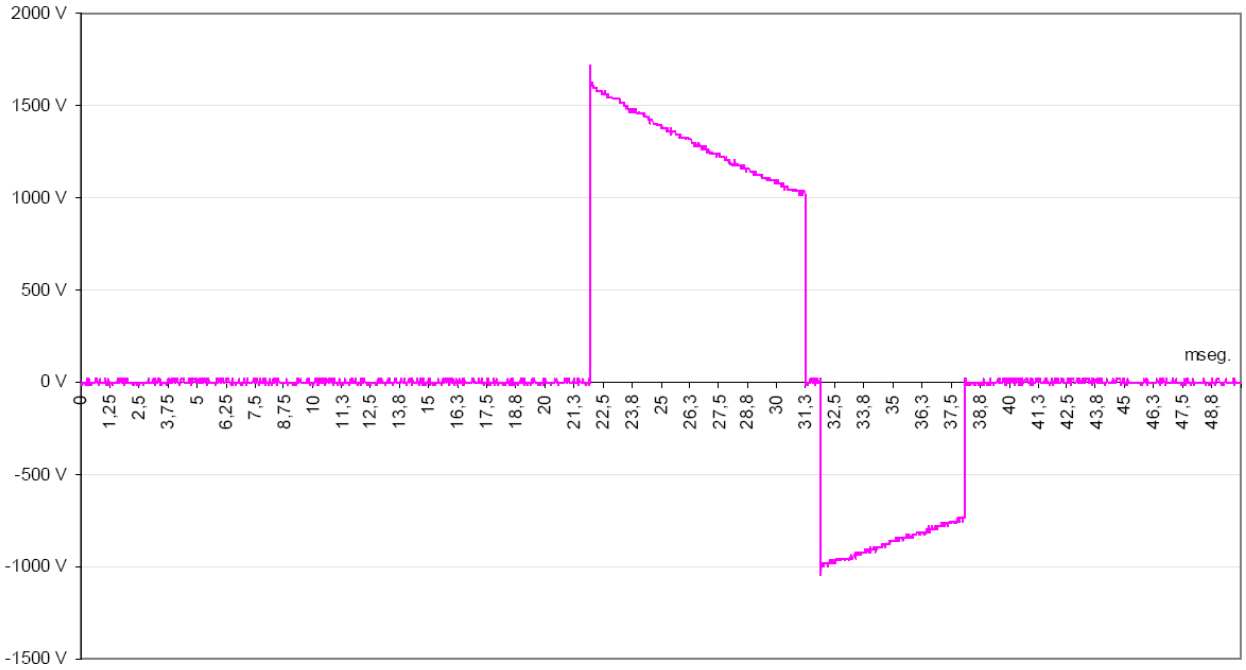
Impedancia Paciente de 25 Ω



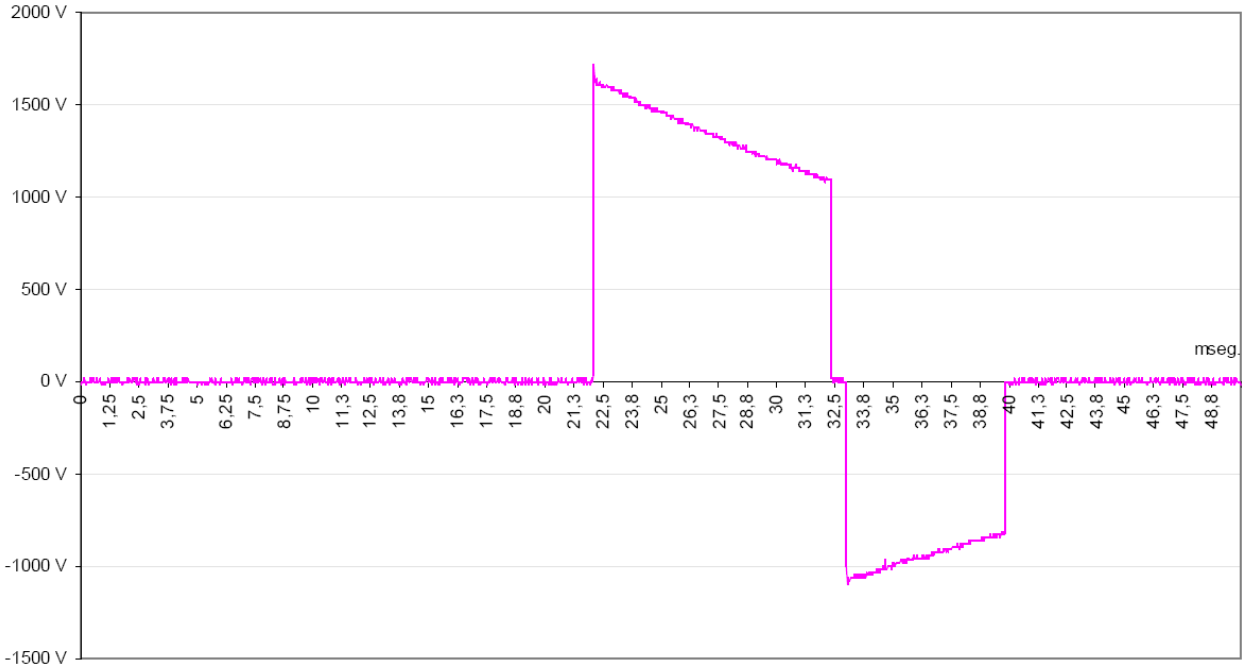
Impedancia Paciente de 50 Ω



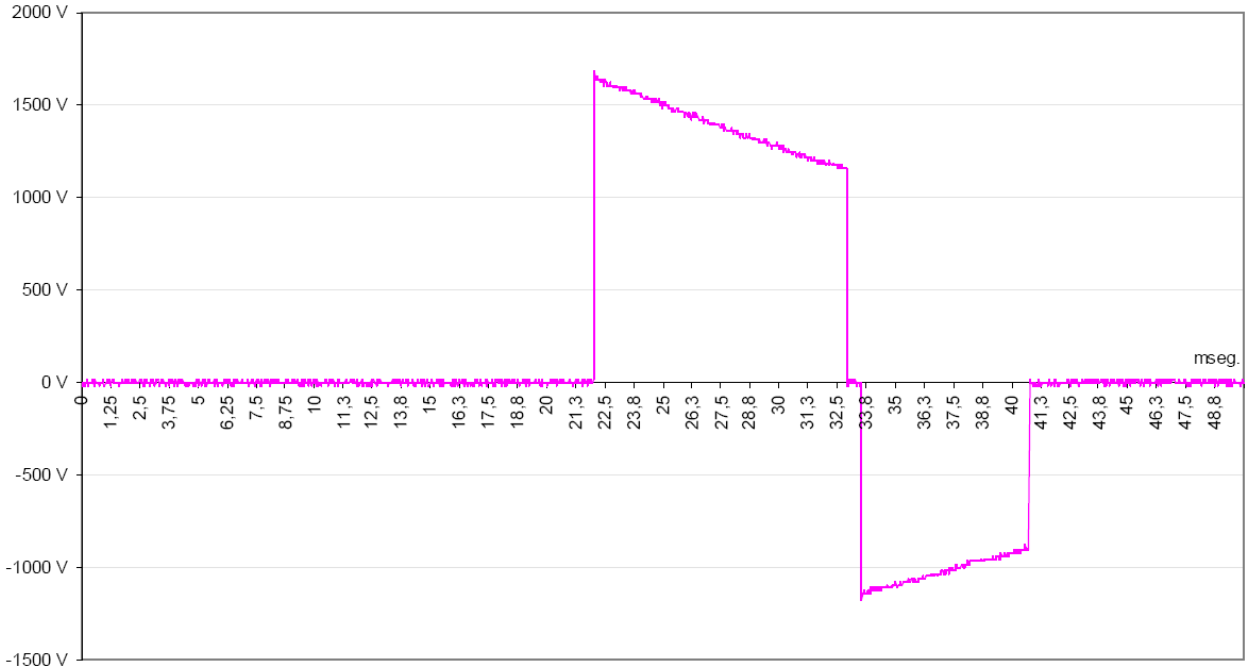
Impedancia Paciente de 75 Ω



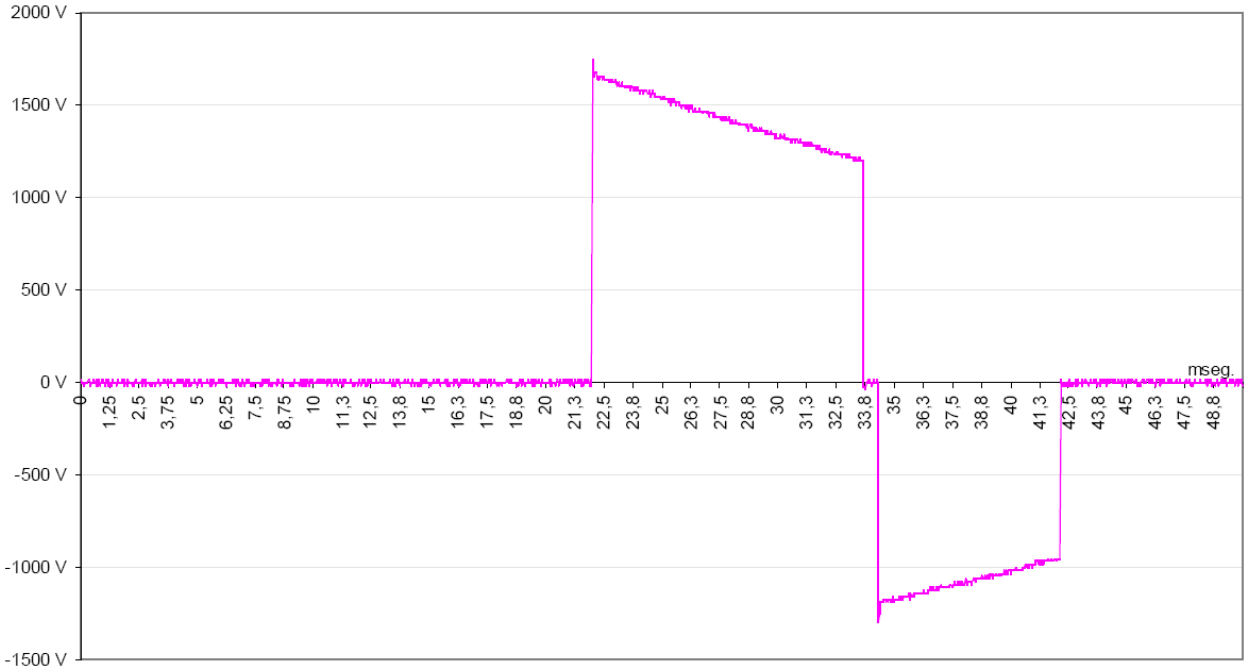
Impedancia Paciente de 100 Ω



Impedancia Paciente de 125 Ω



Impedancia Paciente de 150 Ω



Impedancia Paciente de 175 Ω

Clinical evaluation of the results obtained

At the present time greater efficiency has been demonstrated for biphasic wave defibrillation than for traditional single-phase waves, since they require less energy for this purpose; it also being noted that the displacements that the aforementioned wave gives rise to on the ST segment of the ECG are less, likewise presenting lower incidence of cardiac dysfunction after defibrillation.

3.3 Rhythms Detector

Rhythms detector recommends a shock if it detects the following:

- Ventricular fibrillation, with a peak-to-peak amplitude of at least 0.2 mV.
- Ventricular tachycardia, that has a heart rate of at least 150 beats per minute and no apparent P waves.

Pacemaker pulses may prevent the Rhythms Detector advice of an appropriate shock, regardless of the patient's underlying rhythm.

Rhythms detector recommends no shock for all other ECG rhythms including asystole (AS), idioventricular rhythms (IV), sinus bradycardia (SB), supraventricular tachycardia (SVT), atrial fibrillation (AF) and flutter, premature ventricular contraction (PVC), heart block (BII) and normal sinus rhythm (NSR). All these rhythms are specifically mentioned in the different international standards. Rhythms detector not continue analyzing the ECG signal once it has detected a shockable rhythm or when charging the energy storage capacitor.

Rhythms detector has been tested using two databases: one used for the development of the rhythms detector and other used for the validation of the rhythms detector.

Each test signal has a minimum duration of 9.8 seconds, with the average duration of 13.4 seconds.

For each ECG test signal the result provided by the rhythms detector was recorded (shockable rhythm or non-shockable rhythm) and the result was compared with the classification and treatment recommendation for this rhythm by clinical experts.

The following describes the development and validation databases:

RHYTHMS	DEVELOPMENT DATABASE	VALIDATION DATABASE	TOTAL
Shockable			
Coarse VF	89	89	198
Rapid VT	40	39	79
Non-shockable			
NSR	94	93	187
SVT	34	33	67
Others *	94	93	187
Asystoles	37	37	74
Intermediate			
Fine VF	16	21	37
Other VT	18	17	35

*The category Other includes AF, PVC, SB, BII and IV.

Validation of the algorithm is based on the sensitibity (Se) and specificity (Sp). Sensitibity and specificity and positive predictive values (PPV) and negative predictive values (NPV) are defined in the following summary of the algoritm decisions.

	RITHM	
ALGORITHM DECISION	**SHOCKABLE**	**NON-SHOCKABLE**
Defibrilable	a = true positives	b = fase positives
Non defibrilable	c = false negatives	d = true negatives

$$Se = \frac{a}{a+c} \quad Sp = \frac{d}{b+d} \quad PPV = \frac{a}{a+b} \quad NPV = \frac{d}{c+d}$$

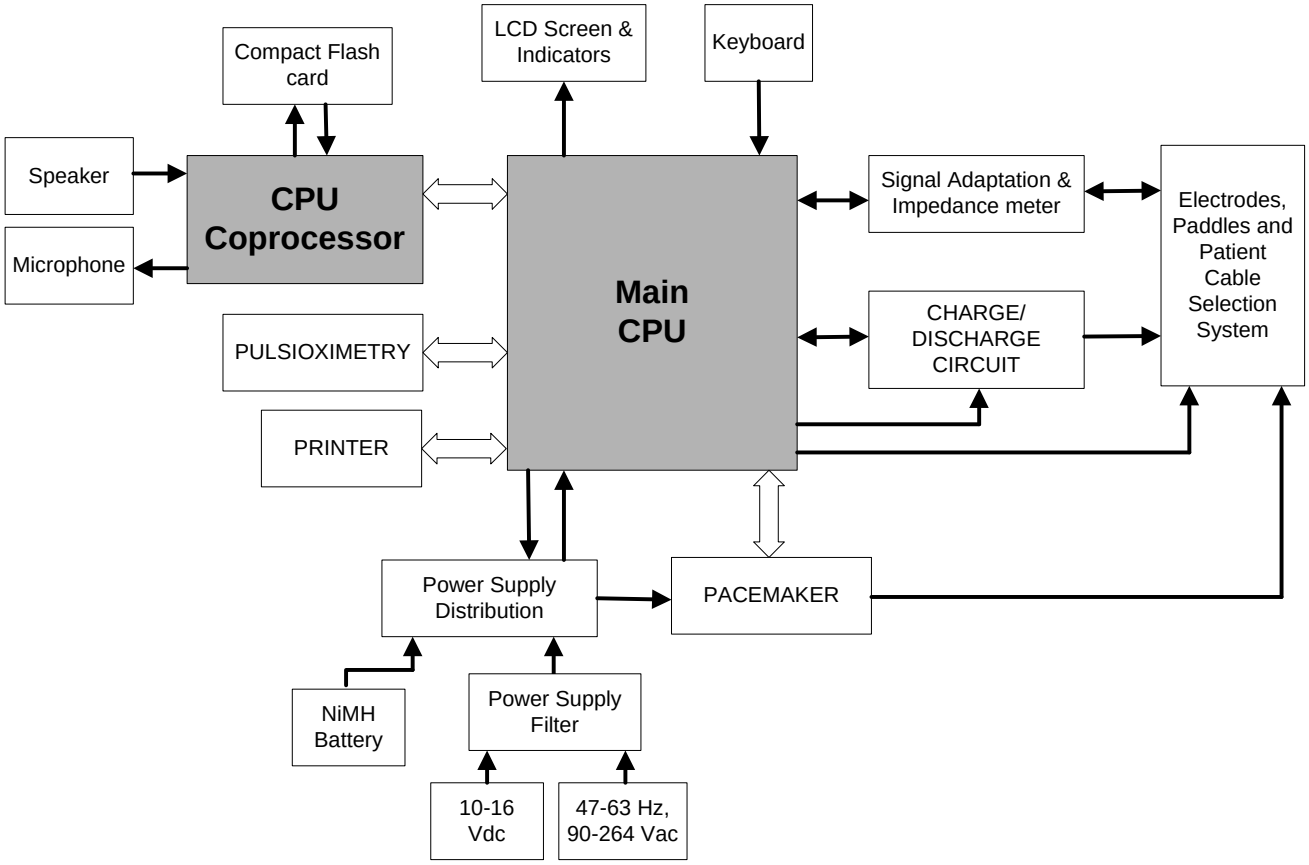
The results obtained wiht these databases:

RITMS	SHOCKABLE	NON-SHOCKABLE	PPV / NPV(%)	SE / SP (%)
Shockable	**277**	**0**	**99.7**	**100**
Coarse VF	198	0	-	100
Rapid VT	79	0	-	100
Non Shockable	**1**	**514**	**100**	**99.8**
NSR	0	187	-	100
Others *	1	327	-	99.7
Intermediate	**27**	**81**	**-**	**-**
Fine VF	25	38	-	93.7
Other VT	2	43	-	94.4

* The category Other includes AF, PVC, SB, BII, IV, SVT and Asistoles.

4. General Block Diagram

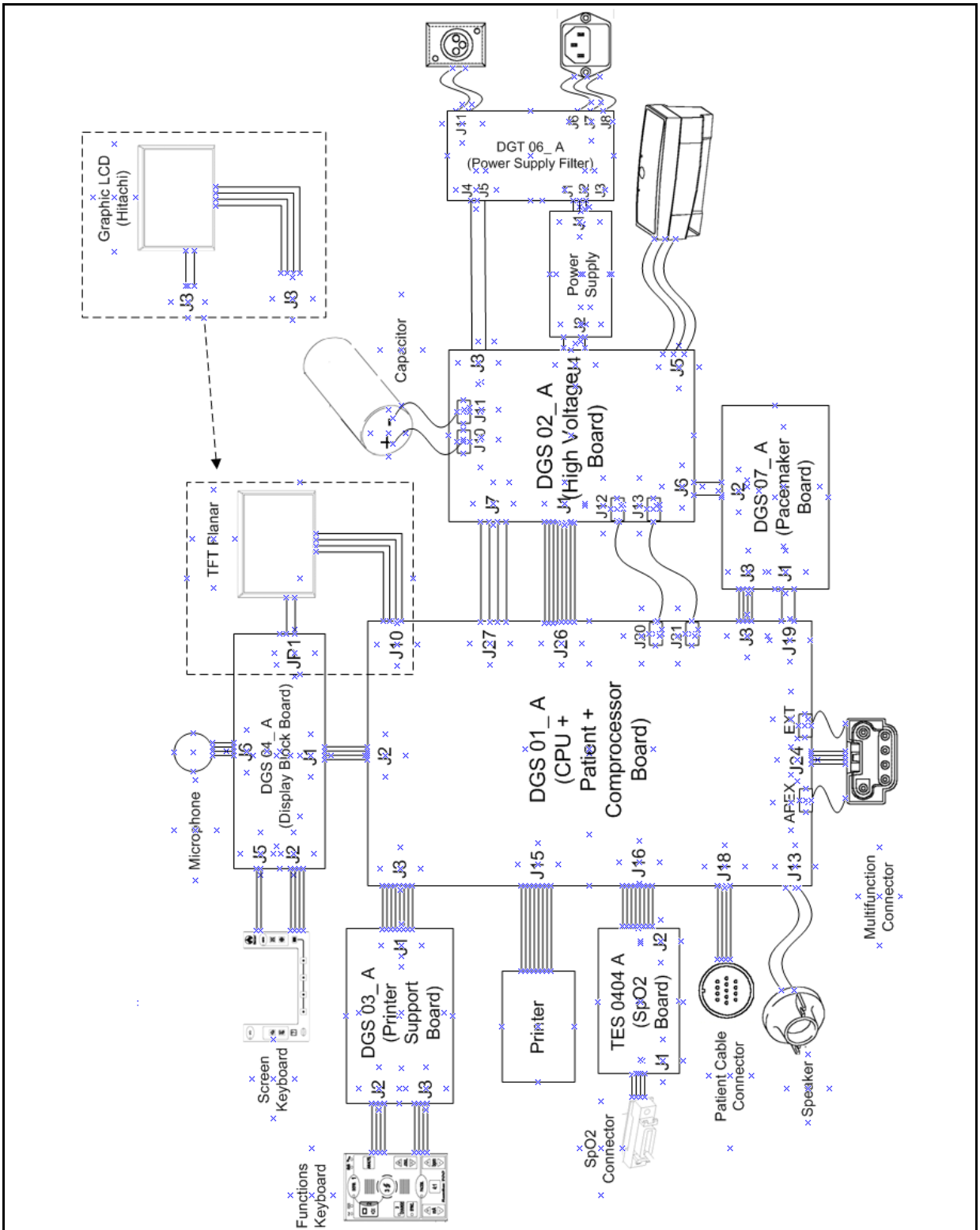
The following diagram shows the blocks that form part of the REANIBEX 700 Series and how they are inter-connected.



General Block Diagram

Blank page

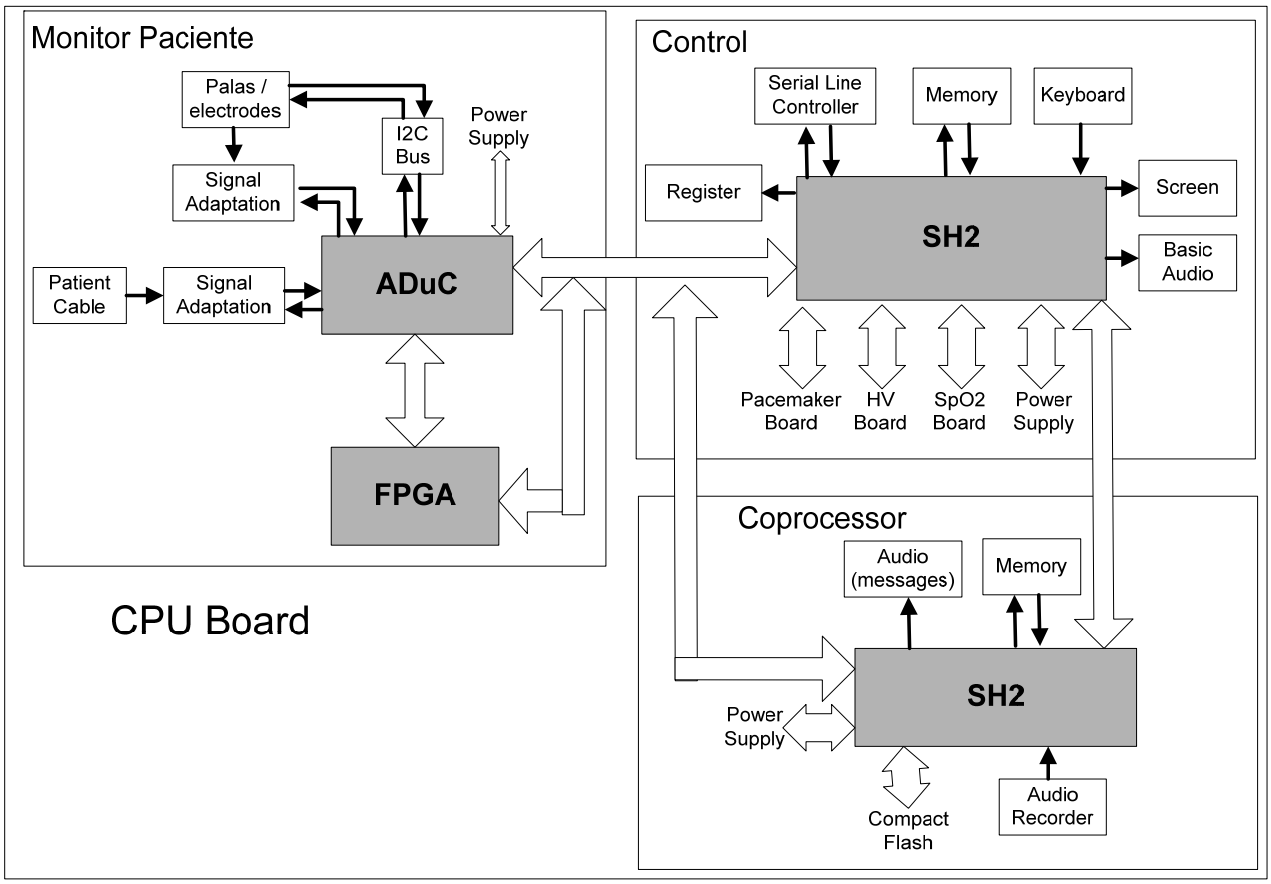
5. Connections Diagram



Blank page

6. CPU Board

6.1 Block Diagram



Block Diagram: CPU Board

6.2 Description

The main function of the CPU Board is to control all the functions that the REANIBEX 700 Series must perform, as well as to carry out the monitoring of the patient, and in case of units that have the Semiautomatic Defibrillator option, to carry out an analysis of the ECG signal, to emit the user guide messages both on-screen and audibly, and to control the interface with the Compact Flash card in which the recording of all of the procedure information is carried out.

In the CPU Board three well-differentiated parts can be distinguished, each of which implements one of the previous functions:

- **CONTROL –** In charge of the control of the different modules of the unit as well as of the control of the user interface elements (on-screen information, indicating LEDs, keyboard and basic audio). Within this area the principal microprocessor is to be found.
- **PATIENT MONITOR -** In charge of the patient interface (both signal capture and provision of treatment) of input signal adjustment, of impedance measurement and of the detection of the QRS complexes for the measurement of the Cardiac Frequency (CF), operation in On-Demand mode of the Pacemaker (optional) and synchronized shock.
- **COPROCESSOR -** Carries out digital processing of the ECG signal (analysis), in order to obtain a diagnosis about whether the signal that is being analyzed corresponds to a defibrillable rhythm or to a non-defibrillable one (issue of diagnosis). It also takes charge of the issue of the audio messages and of the interface with the memory card (signal recording and audio, optionally).

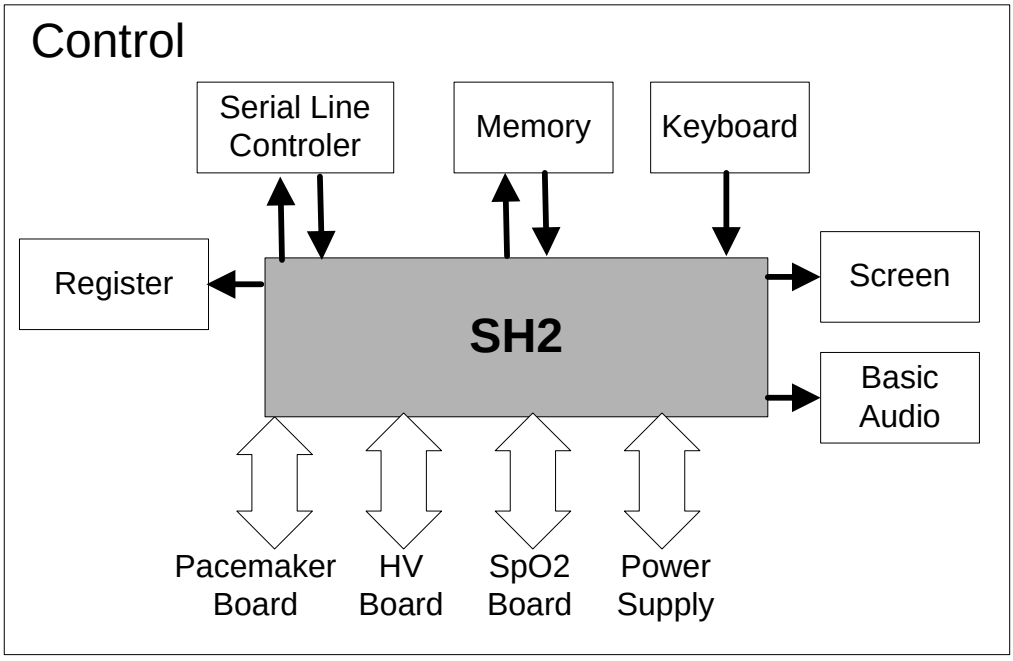
In the following sections, each of these parts is described one in greater detail.

6.2.1 Control

Within this area the principal microprocessor (SH-2 de Hitachi), entrusted with execution of the main software of the REANIBEX 700 Series and of the control of the rest of the modules and cards of the unit, is to be found. Within this processor the main program, which is entrusted with the control of the different elements of the unit, is executed:

- HV Card
- SpO2 Card
- Pacemaker Card
- Patient monitor
- Coprocessor
- Recorder
- Screen
- Keyboards

- Basic audio
- Series line Controller (for recording of the unit software)

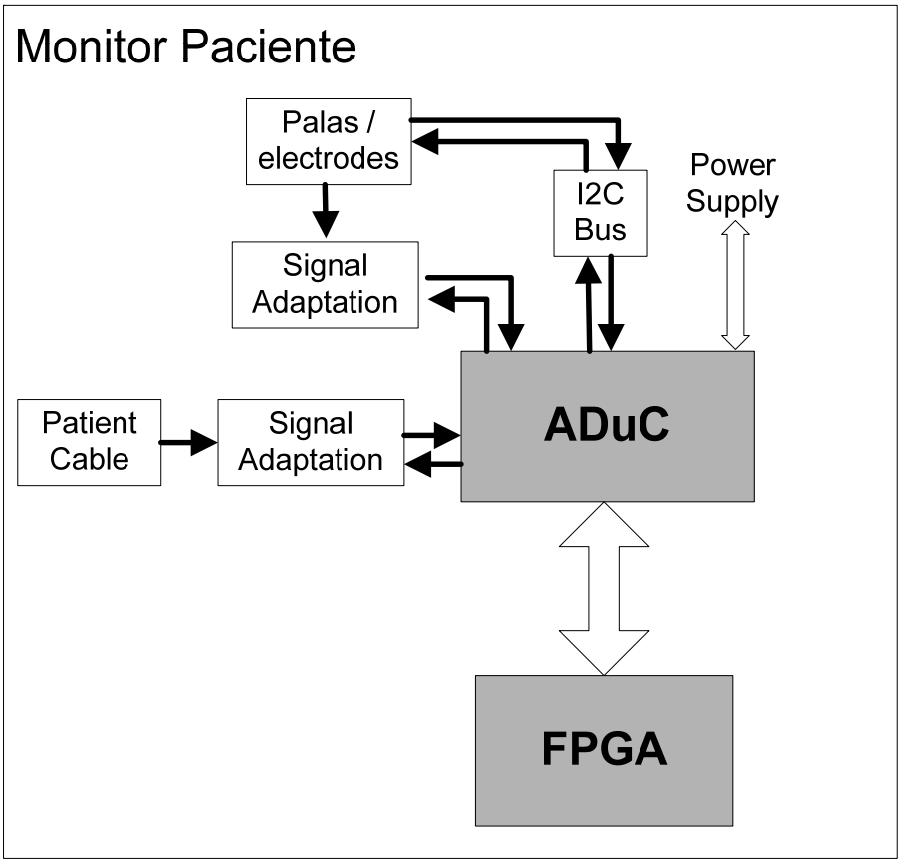


Block diagram: CPU control area

6.2.2 Patient monitor

This module is essentially in charge of the following functions:

- Capture and adapting of the ECG signal
- Detection of the type of paddles or electrodes connected and of the type of patient cable connected to the equipment
- Communication with the reusable external paddles
- User interface for providing treatment by means of the electrodes or the paddles
- Measurement of the impedance of the patient
- Detection of the QRS complexes for obtaining the Cardiac Frequency, for operation in On-Demand mode of the Pacemaker (optional) and for synchronization of shock in synchronized Cardioversion.



Block diagram: Patient Monitor

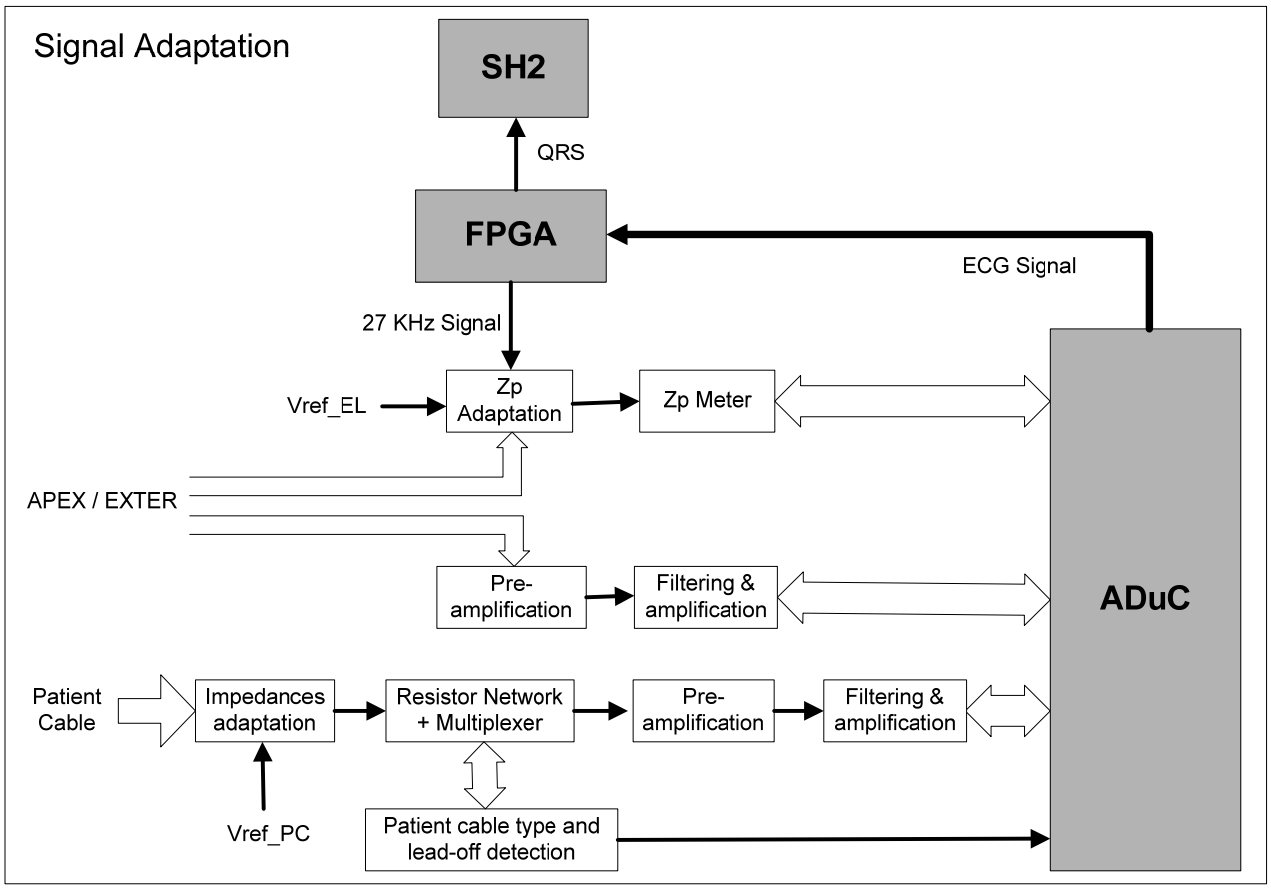
ECG signal capture can carry out by means of them following elements:

- Reusable external or internal paddles
- Multifunction disposable electrodes
- Patient cable that can be 4, 5 and 10 lead

This module has the following characteristics:

- Protection against external defibrillation shocks of 5000V
- High input impedance
- High common mode rejection
- Low input Offset
- It is opto-coupled from high voltage section of the board

Furthermore it adapts the patient signal, where different parts can be differentiated:



Block diagram: Signal adaptation

A) **Measurement of the impedance of the patient –** necessary in order to determine the capacitor charge voltage, also permitting it to be determined if the disposable defibrillation electrodes or the paddles are correctly placed on the patient.

Measurement of the impedance of the patient (Zp) is carried out by injecting an electrical signal to the patient through the defibrillation electrodes. This is a 27 KHz sine wave signal, of 1 mA, in a way that does not affect the patient. It is isolated and it is generated by the FPGA.

The impedance meter is capable of distinguishing four situations depending on the patient's impedance:

- Electrodes in short circuit (Zp <15 Ohms)
- Patient connected (15 ÷ 300 Ohms)
- Electrodes badly connected (300 ÷ 2000 Ohms)
- Patient not connected (Zp > 2000 Ohms)

B) **QRS Detection** – The purpose of this module is the detection of onset of rise of QR in order to allow the calculation of the cardiac frequency.

QRS detection is also necessary in order to synchronise the discharge of the defibrillation pulse with the ECG, in the case that the Synchronisms option in <Manual >Defibrillator mode is activated, or in the case of Ventricular Tachycardia (VT) in Semiautomatic Defibrillator mode. The QRS ONSET must be detected in a time less than that given in the following sections: ANSI/AAMI DF2-1996 section 4.3.17, IEC 60601-2-4 section 104. It is recommended that the time be less than 60 msec.

The shock is synchronized in both cases with the QR ONSET, at 30msec ± 5 msec from the start of the ONSET.

This meter allows frequency cardiac of up to 300 pulses per minute to be detected.

The detection of the QRS complexes is performed in the FPGA, and it is indicated to the main processor that obtains the heart rate, taking into account this information.

C) **Detection of the Type of cable connected and of a loose lead -** This part is entrusted with determining what type of cable is connected to the REANIBEX 700Series and with detecting if any of the leads of the above-mentioned cable are disconnected. Depending on the type of patient cable and of the leads that are disconnected different outputs will be obtained and visualized.

D) **Adaptation and filtering of the ECG signal -** It is necessary to adapt the ECG signal to the characteristics of the equipment, whether it be captured by the electrodes or by the paddles or by the patient cable. For this purpose adjustment is made in gain and the signal is filtered. All of this processing allows to the ECG signal to be correctly visualized on-screen.

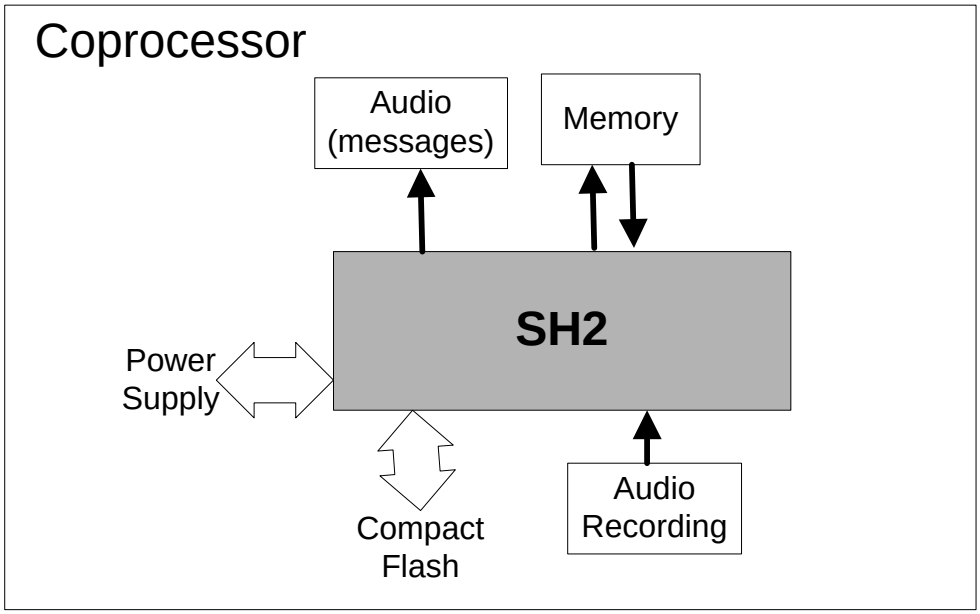
The processing of the patient cable signal is isolated from the processing of the signal obtained from the electrodes/paddles.

6.2.3 Coprocessor (Optional)

This module is only present in those units that have the Semiautomatic Defibrillator option. The functions of this module are the following:

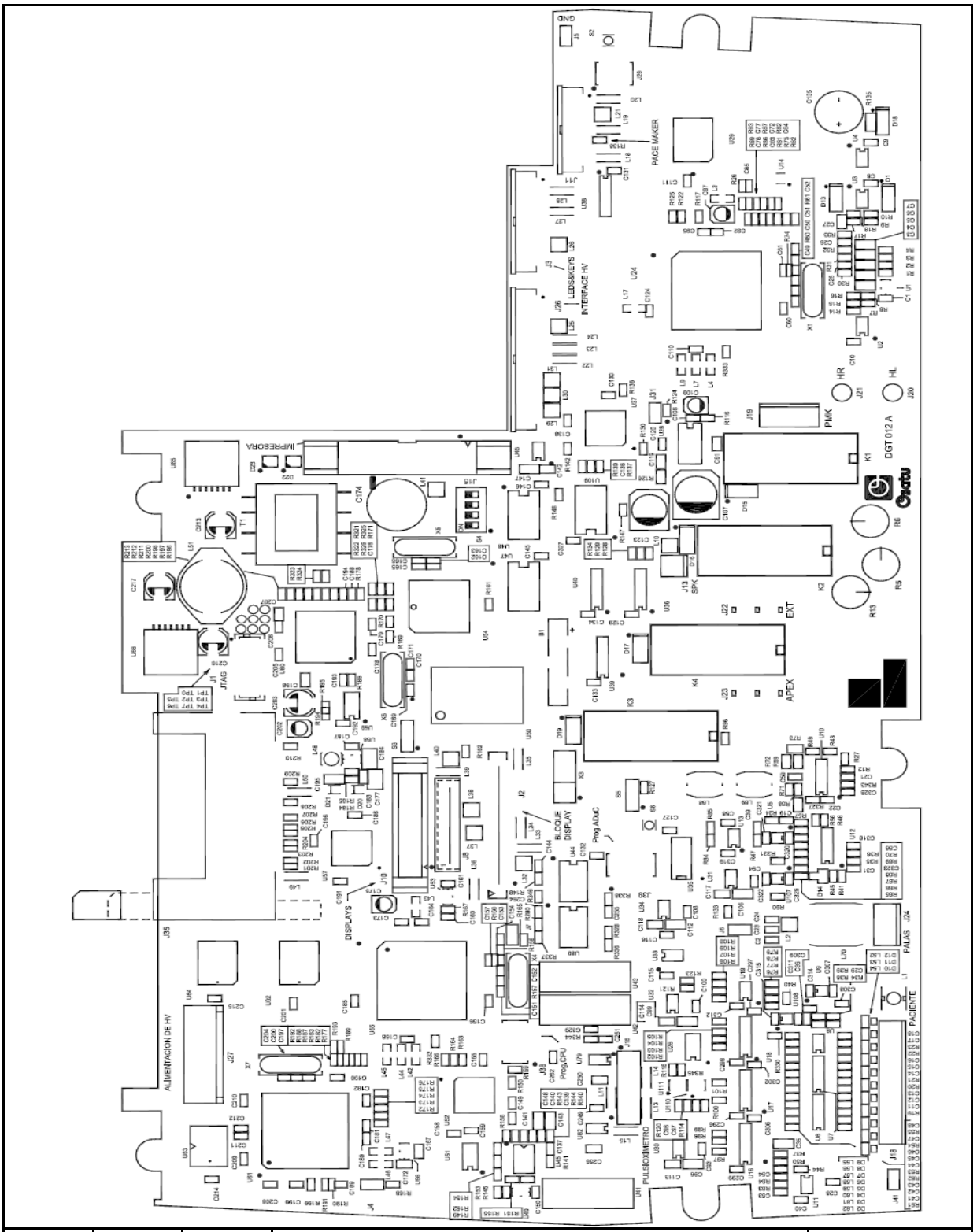
- Analysis of the ECG signal samples and issue of a diagnosis
- Issuing of audio messages that guide to the user in his procedure

- Audio recording both of the unit and of the scene
- Management of the interface with the Compact Flash memory card for recording both the ECG signal samples, and the events, and optionally the audio when working in Semiautomatic Defibrillator Mode.

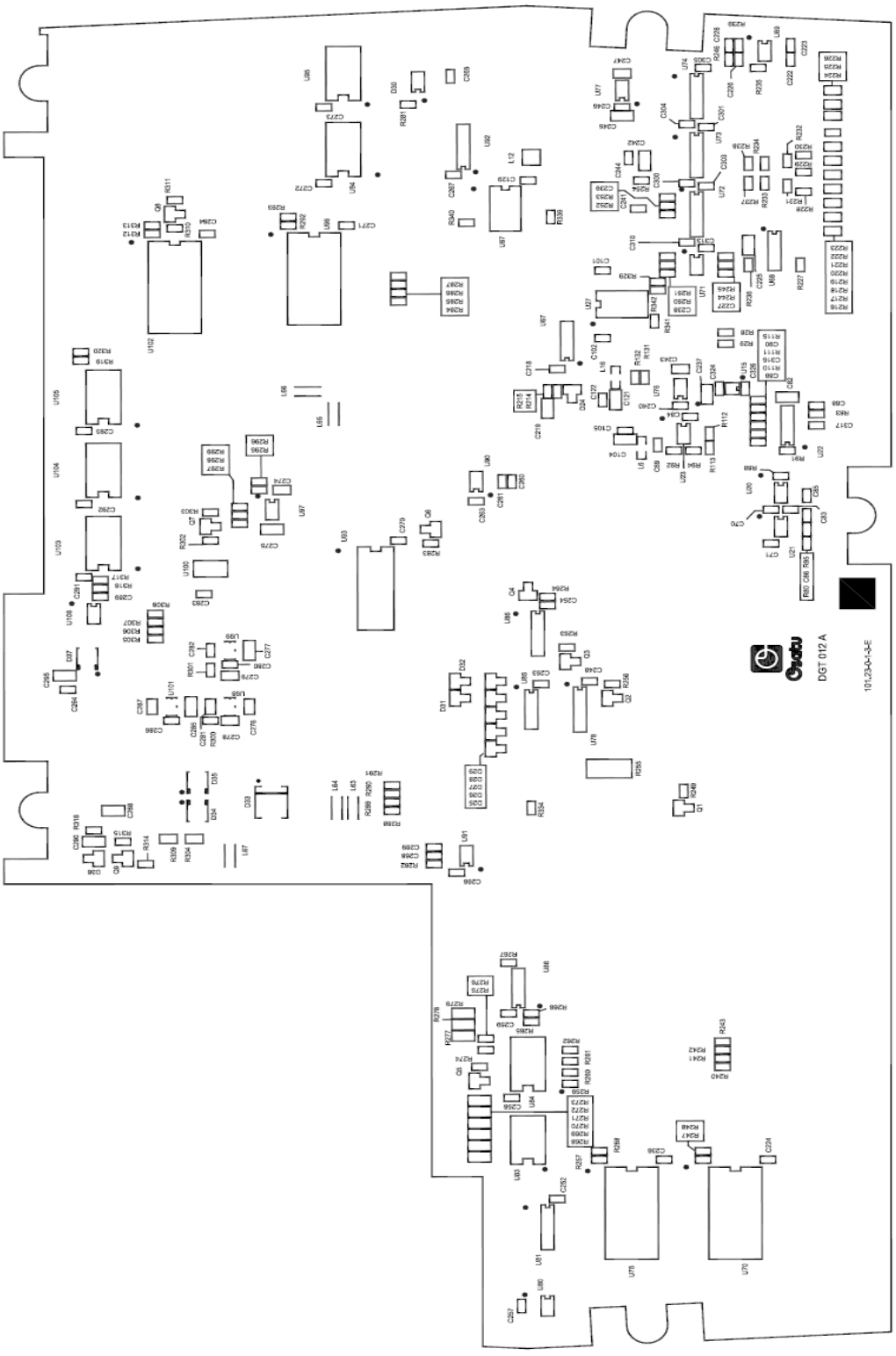


Block diagram: Coprocessor

6.3 Location of Components



DIBUJADO:	REVISADO:	ESCALA / CANT.	**Location of Components CPU Board (I)**	Osatu, s. coop.
ANULA A / FECHA:			DENOMINACION:	CODIGO:



DIBUJADO:	REVISADO:	ESCALA / CANT.	**Location of Components CPU Board (II)**	Osatu, s. coop.
ANULA A / FECHA:			DENOMINACION:	CODIGO:

6.4 List of Materials

ITEM	QTY	PART NUMBER	DESCRIPTION	REFERENCES
1	5	ADG619BRMZ	Switch 4 ohms SPDT cmos 2.7 a 5.5V, uSO8 (AD)format	U5,U9,U15, U107-U108
2	1	ADUC814ARUZ	12-bit ADC microcontroller with embedded FLASH, format TSSOP28 (AD)	U35
3	1	ADuM1250ARZ	Hot Swappable Dual I2C Isolator, SO8 (ANALOG DEVICES)	U33
4	4	ADuM1401ARWZ	Quad-Channel Digital Isolators, 1Mbps, SOL16 (ANALOG DEVICES)	U27,U44,U87,U89
5	2	AD620AR	Instrumental amplifier I.C of low cost, SO8 (AD)	U11,U20
6	1	AD7992BRMZ-0	12bit ADC, 2 channels with I2C, format MSOP-10 (ANALOG DEVICE)	U25
7	2	AD8606ARZ	2 CMOS operational amplifier I.C. with low noise SO8 (ANALOG).	U19,U23
8	1	AT29LV256-15TC	32K x 8 Flash Memory, format TSOP28 (ATMEL).	U63
9	1	AT93C46DN-SH	Serial Access EEPROM (128X8), format SO8	U4
10	3	Am29F040B-70JF	4Mbit of capacity CMOS Flash Memory (70ns-Industrial) format PLCC-32 (SPANSION).	U29,U62,U64
11	1	A6S4101	4 Micro-switches format SMT (OMRON).	S4
12	9	BAS116	Fast Diode Ifm=250mA, Vr=75V, Vf=1.25V format SOT23 (Infineon).	D24-D29,D31-D32,D36
13	1	BAT54S	Double fast diode in series If=300mA, Vr=30V, format SOT23 (ST).	D14
14	11	BAV199	Double fast diode in series If=200mA, Vr=70V, format SOT23 (INFINEON).	D2-D12
15	7	BC817	NPN transisitor with format SOT23.	Q1-Q6,Q9
16	14	BLA31AG102SN4	4 ferrites array Z=1K (100MHz), I=0.05A (MURATA).	L2,L10,L12, L21,L25-L26,L29-

				L32,L37-L38,L40-L41
17	11	BLM18BD102SN1	Interferences suppresor Z=1K (100MHz), I=0.1A format 0603 (MURATA).	L52-L62
18	24	BLM41PG102SN1	Interferences suppresor Z=1K (100MHz), I=1.5A (MURATA)	L11,L13-L15,L18-L20,L22-L24,L27-L28,L33-L36,L39,L49-L50,L63-L67
19	1	B82442-H1475-K	SMD Induction 4700uH/10% 0.05A 62.4omhs 0.9MHz (EPCOS)	L1
20	2	B82790-C0475-N265	Double coil shock 4,7mH/0.2A (EPCOS).	L68-L69
21	1	B82792-C2475-N365	4 coil shock 4,7mH/0.2A (EPCOS).	L70
22	1	C-MAC_3.6864MHz_HC49/4HSMX	3.6864MHz Quartz crystal SMD format HC49/4HSMX (C-MAC).	X5
23	2	C-MAC_6.144MHz_HC49/4HSMX	6.144MHz Quartz crystal SMD format SMD HC49/4HSMX (C-MAC).	X1,X4
24	2	C-MAC_10MHz_HC49/4HSMX	10MHz Quartz crystal SMD format HC49/4HSMX (C-MAC).	X6-X7
25	1	CD74HC574M	8 Latch D- Type I.C. (Tri-state) SOL20 (TI).	U47
26	1	CENVALSA_2545-2021	2-pins straight male connector pitch 2.54 (CENVALSA).	J13
27	1	CENVALSA_2545-2041	4 pins straight male connector pitch 2.54 (CENVALSA).	J24
28	1	CENVALSA_2545-2051	5 pins straight male connector pitch 2.54 (CENVALSA).	J19
29	1	CENVALSA_2545-2121	12 pins straight male connector pitch 2.54 (CENVALSA).	J18
30	1	CENVALSA_3951-2061	6-pins straight male connector pitch 1.14mm, paso 3.96mm (CENVALSA).	J27
31	1	COILCRAFT_Q4434-B	Trafo para LM258x regulador Flyback, 22uH 1:1 (Coilcraft)	T1
32	2	CON_1PIN_TAL1.75_PAD3.5	Pad for soldering 1 mm diameter wire	J20-J21
33	1	CRM221M1CF	SMD electrolitic capacitor 220uF/16V 20%	C123

			(JAMICON)	
34	1	CR2032FP2	3V capacity button battery 180mAh assembly in pcb vertical (VARTA).	B1
35	1	CYBIT_ASC100-BGLI	DSP ref.(TI) TMS320VC5402PGE100 recorded with the compression algorithm, format LQFP144 (CYBIT).	U61
36	1	CY62256NLL-55SNXI	SRAM memory 32768x8 bits of 55ns SOP28 (CYPRESS).	U93
37	1	C_P_ELER_2200uF_16V_20%_LESR	Radial electrolitic capacitor 2200uF/16V 20% Low ESR	C174
38	4	C_S_ELER_10uF_25V_20%	Panasonic SMD electrolitic capacitor 10uF/25V 20% ECEV1EA100WR	C87,C109,C175,C202
39	1	C_S_NP0_2.7pF_50V_5%_0603	SMD Capacitor 0603 NP0 2.7pF/50V 5%	C171
40	5	C_S_NP0_3.3pF_50V_5%_0603	SMD Capacitor 0603 NP0 3.3pF/50V 5%	C163,C166,C170,C260-C261
41	2	C_S_NP0_10pF_50V_5%_0603	SMD Capacitor 0603 NP0 10pF/50V 5%	C200,C204
42	4	C_S_NP0_22pF_50V_5%_0603	SMD Capacitor 0603 NP0 22pF/50V 5%	C49-C50,C151-C152
43	2	C_S_NP0_33pF_50V_5%_0603	SMD Capacitor 0603 NP0 33pF/50V	C162,C165
44	1	C_S_X7R_3.9nF_50V_10%_0603	SMD Capacitor 0603 X7R 3.9nF/50V 10%	C228
45	1	C_S_X7R_47nF_50V_10%_0805	SMD Capacitor 0805 X7R 47nF/50V 10%	C119
46	4	C_S_X7R_100nF_50V_10%_0805	SMD Capacitor 0805 X7R 100nF/50V 10%.	C91,C142,C183,C274
47	1	C_S_X7R_180nF_50V_10%_1206	SMD Capacitor 1206 X7R 180nF/50V 10%	C35
48	1	C_S_X7R_220nF_50V_10%_1206	SMD Capacitor 1206 X7R 220nF/50V 10%	C195
49	8	C_S_X7R_330nF_16V_10%_0805	SMD Capacitor 0805 X7R 330nF/16V 10%	C113-C114,C117-C118,C243,C247,C250,C256

50	1	C_S_X7R_330nF_25V_10%_1206	SMD Capacitor 1206 X7R 330nF/25V 10%	C147
51	1	C_S_X7R_330pF_50V_10%_0603	SMD Capacitor 0603 X7R 330pF/50V 10%	C120
52	7	C_S_X7R_470pF_50V_10%_0603	SMD Capacitor 0603 X7R 470pF/50V 10%	C2,C23-C24,C52,C137,C139,C154
53	2	C_S_Y5V_1uF_50V_20%_1206	SMD Capacitor 1206 Y5V 1uF/50V 20%	C275,C288
54	1	C_S_Y5V_3,3uF_10V_20%_0805	SMD Capacitor 0805 Y5V 3,3uF/10V 20%	C27
55	4	C_S_Y5V_4.7uF_16V_20%_1206	SMD Capacitor 1206 Y5V 4.7uF/16V 20%	C4-C7
56	1	C0603C105K8PAC	SMD capacitor 0603 X5R 1uF/10V 10% (KEMET)	C329
57	9	C1206C106K4PAC	SMD capacitor 1206 X5R 10uF/16V 10% (KEMET)	C96,C99,C104,C106,C112,C121,C219,C237,C245
58	1	DO1608C-103	SMD Coil. COILCRAFT. 10uH	L48
59	1	DO5022P-473	SMD power coil. COILCRAFT. 47uH	L51
60	1	DS1302Z	Clockin real time format S8 (DALLAS).	U90
61	1	EECS0HD-223H	Radial superCap 22mF/5V5 20% D10x5,5mm R10mm (PANASONIC)	C135
62	1	EHT-110-01-S-D-SM	10x2 pins SMD male connector pines pitch 2mm, with ears (SAMTEC).	J10
63	1	BCS-107-L-D-TE	7+7 pins straight female connector pitch 2.54 (SAMTEC).	J16
64	2	FASTON_V_6.35	1 pin FASTON vertical connector (AMP)	J22-J23
65	1	FCI_SFW16R-1ST	16 pins FFC right angle connector raster 1 lower contact (FCI).	J11

66	1	FCI_SFW20R-1ST	20 pins FFC right angle connector raster 1 lower contact (FCI).	J3
67	1	FCI_SFW30R-1ST	30 pins FFC right angle connector raster 1 lower contact (FCI).	J26
68	1	FCI_SFW30S-2ST_MOLEX_52610-3090	30 pins FFC straight connector raster 1 (FCI o molex).	J2
69	2	GRM31MR71C225KA35L	SMD Capacitor 1206 X7R 2,2uF/16V 10% (MURATA)	C277,C285
70	2	GRM32ER71H475KA88L	SMD Capacitor 1210 X7R 4u7F/50V 10% (MURATA).	C177,C184
71	1	GRM1885C1H152JA01D	SMD capacitor 0603 COG 1,5nF/50V 5% (MURATA)	C22
72	2	HD64F7044F28	32bit microprocessor, 256K FLASH, 4K RAM, 1K cache, 28MHz, QFP112 (HITACHI).	U24,U55
73	1	HEF4051BT	1 Analog Multiplexes/Demultiplexes of 8 channes I.C. SO16 (PHILIPS).	U72
74	6	HEF4052BT	2 Analog Multiplexes/Demultiplexes of 4 channes SO16 (PHILIPS).	U16-U18,U73-U74,U92
75	1	HJW8J0101E50	100 ohms resistor 5% tolerance, 125mW power, format 1206 (ROYAL OHM).	R135
76	4	HMWAF0123E50	12K ohms resistor 1% tolerance 100mW power, format 0805 (ROYAL OHM).	R57,R59,R72-R73
77	16	HPWGF0102E50	1K resistor, 1%, 63mW, 0603 (ROYAL OHM).	R82,R86-R87,R89,R93,R127,R131-R132,R167,R223,R253,R305-R308,R323
78	47	HPWGF0103E50	10K resistor, 1%, 63mW, 0603 (ROYAL OHM).	R1,R3-R4,R28-R29,R31-R32,R41,R43,R45,R58,R67,R71,R97-R105,R138,R145,R155,R161,R274,R283,R288-R291,R294,R296-

				R299,R302-R303,R310-R311,R314-R315,R321-R322,R327, R334
79	17	HPWGF0104E50	100K ohms resistor, 1%, 63mW, 0603 (ROYAL OHM).	R19-R23,R47,R51-R55,R84-R85,R250-R252,R295
80	8	HPWGF0153E50	15K resistor, 1%, 63mW, 0603 (ROYAL OHM).	R49,R63-R64,R80,R95,R281,R301,R343
81	22	HPWGF0203E50	20K ohms resistor 1% tolerance 63mW power, format 0603 (ROYAL OHM).	R12,R35,R66,R149,R172-R177,R182, R188,R190-R192,R199, R228,R230-R232,R237-R238
82	2	HPWGF0220E50	22 ohmS resistor 1% tolerance 63mW power, format 0603 (ROYAL OHM).	R332-R333
83	2	HPWGF0222E50	2K2 resistor, 1%, 63mW, 0603 (ROYAL OHM).	R121,R123
84	4	HPWGF0223E50	22K ohm resistor 1% tolerance 63mW power, format 0603 (ROYAL OHM).	R152,R154, R235,R300
85	38	HPWGF0472E50	4K7 ohm resistor 1% tolerance 63mW power, format 0603 (ROYAL OHM).	R15-R16,R36,R56,R68-R69,R124,R165,R168,R178,R183,R186-R187,R193, R201-R210,R241, R249,R256, R259-R264,R275-R276,R285, R316-R317
86	9	HPWGF0473E50	47K ohm resistor 1% 63mW, format 0603 (ROYAL OHM).	R24,R46,R65,R120,R244-R245,R267,

				R319-R320
87	1	HPWGF0823E50	82K ohms resistor 1% tolerance 63mW power, format 0603 (ROYAL OHM).	R27
88	1	HPWGF1242E50	12K4 ohm resistor, 1%, 63mW, 0603 (ROYAL OHM).	R88
89	2	HPWGF2373E50	237K ohms resistor 1% tolerance 63mW power, format 0603 (ROYAL OHM).	R40,R90
90	1	HPWGF2801E50	2K8 resistor 1% tolerance 63mW power, format 0603 (ROYAL OHM).	R236
91	2	HPWGF3304E50	3,3 Mohms resistor 1% tolerance 63mW power, format 0603 (ROYAL OHM).	R330-R331
92	3	HPWGF3742E50	37K4 ohm resistor, 1%, 63mW, 0603 (ROYAL OHM).	R39,R70,R111
93	1	HPWGF4991E50	4K99 resistor, 1%, 63mW, 0603 (ROYAL OHM).	R91
94	11	HPWGF4992E50	49K9 ohm resistor, 1%, 63mW, 0603 (ROYAL OHM).	R76-R79,R92,R94,R106-R107,R109,R112-R113
95	1	HPWGF5230E50	523 ohms resistor, 1%, 63mW, 0603 (ROYAL OHM).	R324
96	2	HPWGF5231E50	5,23 Kohms resistor, 1%, 63mW, 0603 (ROYAL OHM).	R325-R326
97	2	HPWGF6652E50	66K5 ohm resistor, 1%, 63mW, 0603 (ROYAL OHM).	R34,R83
98	2	HPWGF8452E50	84K5 ohm resistor 1% tolerance 63mW power, format 0603 (ROYAL OHM).	R38,R115
99	1	HPWGF9312E50	93K1 ohm resistor 1% tolerance 63mW power, format 0603 (ROYAL OHM).	R110
100	63	HPWGJ0000E50	0 ohm resistor, 5%, 63mW, 0603 (ROYAL OHM).	R14,R62,R75,R81,R117-R118,R122,R125,R128-R130,R133-R134,R136-R137,R139,R142,R146-R148,R150,R156,R159,R162-R164,R166,

				R194-R198,R200, R211-R212,R240, R242-R243,R246-R248,R254, R257-R258,R265-R266,R280, R284,R286-R287,R292-R293,R312-R313,R328-R329,R336-R342
101	1	HPWGJ0331E50	330 resistor 5% tolerance 63mW power, format 0603 (ROYAL OHM).	R213
102	1	HPWGJ0332E50	3,3K resistor, 5%, 63mW, format 0603 (ROYAL OHM).	R344
103	3	HS-5-470R-5%	470 resistor 5% tolerance 5W power, serie HS-5 (TECNOMEGA).	R5-R6,R13
104	3	IH0509S-H	DC-DC converter 5V/±9V ±111mA format SIP7 (XP-POWER).	U41-U43
105	1	IQD_32.768KHz_90SMX	32.768 KHz quartz crystal format 90SMX (IQD).	X3
106	2	KMR221G	SMD mini-pushbutton(ITT)	S2,S6
107	1	LD1117S33	3V3 Low Dropout voltaje regulator, 800mA format SOT223 (ST)	U100
108	2	LMC6484IM	4 CMOS operational amplifiers I.C. SO14 (NS).	U10,U12
109	3	LMV321M5	Low voltaje operational amplifier, format SOT23-5 (NS)	U1,U49,U53
110	1	LMV358M	Low voltaje operational amplifier, format SO8 (NS)	U3
111	1	LM385M-1.2	1.235V Zener diode, format SO8 (NS).	D30
112	1	LM386N-4	Low voltaje audio amplifier format, DIP8 (NS)	U28
113	1	LM392M	Double Operacional I.C. one comparator and the other amplifier, SO8 (NS).	U97
114	1	LM2588S-12	Adjustable Flyback regulator of 5 Amp with shutdown, format TO263-7pins	U65

			(NATIONAL).	
115	1	LM2676S-5.0	Adjustable commutable regulator of 3 Amp with shutdown, format TO263-7pins (NATIONAL).	U66
116	1	LP2985-33DBVTE4	3,3V/150mA voltaje regulator of low noise and Ultra Low-Dropout, format SOT23-5 (TI)	U101
117	1	LP8358MF-1.2	2V/150mA, uCap voltaje regulator, Low-Dropout, format SOT23-5 (NS)	U98
118	1	LT1617ES5	DC/DC Inverter converter of low power, format SOT23-5pins (LINEAR).	U58
119	1	MAX706CSA	Microprocessors supervisor circuit, format SO8 (Maxim)	U80
120	2	MAX4126ESA+	2 CMOS operational amplifies I.C of low power, 5MHz, SO8 (MAXIM).	U13,U71
121	1	MAX16033LLB29+T	Low-Power Battery Backup, format 10-uDFN(MAXIM).	U14
122	1	MBRS130LT3	Rectifier Schottky Diode 1A, 30v. MOTOROLA.	D37
123	1	MBRS340T3	Schottky diode If=3A, Vr=40V, format SMC (ON).	D33
124	2	MBR0530T1	Schottky diode If=0.5 Amp, Vrrm=30V, format SOD-123 (ON).	D20-D21
125	1	MC 0.063W 0603 1% 33K2	33,2K Resistor, 1%, 63mW, 0603 (MULTICOMP).	R114
126	1	MC 0.063W 0603 1% 107K	107K Resistor, 1%, 63mW, 0603 (MULTICOMP).	R227
127	2	MC74HC14AD	6 INVERER gater I.C (HISTERESIS) SO14 (TI).	U67,U88
128	6	MC78L05ACD	5V voltaje regulator, format SO8 (MOT).	U30-U32,U34,U46,U79
129	3	MC79L05ACD	-5V negative voltaje regulator, format SO8 (MOT).	U76-U77,U82
130	1	MM74HCT244WM	2 Tri-state Buffers I.C. of 4 bit SOL20 (FAIRCHILD).	U109
131	1	MOLEX_5597-14CPB	14 pins FFC straight connector with ZIP fixation raster 1.25 (Molex).	J8

132	1	MURS120T3	Ultra-fast diode If=1A, V=200, trr=35ns , format SMB (ON)	D34
133	1	M25P10-AVMN6P	1Mbit Flash Memory, serial access SPI 2V3-3V6, format SO8 (ST).	U106
134	1	NE555D	Timer de Fmax = 500MHz, format SO8 (Philips).	U91
135	7	NFE31PT222Z1E9	2200pF EMI capacitor filter for direct voltaje (muRata)	L3,L6,L16-L17,L43,L46-L47
136	6	NFW31SP506X1E4	EMI filter for hight speed lines (muRata)	L4,L7,L9,L42,L44-L45
137	1	OPA2604AU	2 operational amplifies I.C. of FET input and low distorsion, SO8 (BB).	U21
138	1	OP97FSZ	High precisión and low comsuption amplifier, SO8 (AD).	U69
139	1	OP2177ARZ	2 CMOS operation amplifiers I.C. of low power SO8 (TI).	U8
140	2	OP4177ARZ	4 CMOS operation amplifiers I.C. of low power SO8 (TI).	U6-U7
141	1	OUPIIN 3213-40C00SB2A	2x20 pins straight flat cable connector pitch 1.27mm (OUPIIN).	J15
142	1	PCF8574PW	Remote 8-Bit I/O expander for I2C bus, TSSOP20 (TI)	U26
143	3	PMLL4148	Fast diode Ifrm=450mA, Vr=75V, format SOD80 (PHILIPS).	D1,D13,D18
144	6	PUENTE_AKS	2 pins bridge raster=2.54	J4-J7,J31,J41
145	2	PUENTE_AKS_2P	3 pins bridge raster=2.54	S3,S5
146	1	RA8835AP3N	LCD display controller format QFP5-60 (RAIO)	U50
147	4	RS1J	Rectifier Diode 1A Vrrm=600V Ifrm=10A, format Do214AC/SMA (Fairchild).	D15-D17,D19
148	1	R_0603_1K2_1%	1K2 resistor 1% tolerance 63mW power, format 0603.	R116
149	1	R_0603_1M_1%	1M resistor 1% tolerance 63mW power, format 0603.	R239

150	1	R_0603_2K7_1%	2K7 ohm resistor 1% tolerance 63mW power, format 0603.	R8
151	3	R_0603_3K_1%	3K resistor 1% tolerance 63mW power, format 0603.	R61,R158,R318
152	2	R_0603_3K3_1%	3K3 resistor 1% tolerance 63mW power, format 0603.	R2,R189
153	4	R_0603_8K2_1%	8K2 resistor 1% tolerance 63mW power, format 0603.	R30,R140,R144,R214
154	2	R_0603_9K76_1%	9K76 resistor 1% tolerance 63mW power, format 0603.	R10,R18
155	1	R_0603_16K_1%	16K ohm resistor 1% tolerance 63mW power, format 0603.	R185
156	1	R_0603_16K5_1%	16K5 ohm resistor 1% tolerance 63mW power, format 0603.	R44
157	2	R_0603_24K9_1%	24K9 resistor 1% tolerance 63mW power, format 0603.	R37,R50
158	1	R_0603_27K_5%	27K resistor 5% tolerance 63mW power, format 0603.	R7
159	3	R_0603_30K1_1%	30K1 resistor 1% tolerance 63mW power, format 0603.	R229,R233-R234
160	2	R_0603_44K2_1%	44K2 resistor 1% tolerance 63mW power, format 0603.	R9,R17
161	1	R_0603_100_0.1%	100 resistor 0.1% tolerance 63mW power, format 0603.	R96
162	2	R_0603_100_1%	100 resistor 1% tolerance 63mW power, format 0603.	R33,R215
163	4	R_0603_120K_1%	120K resistor 1% tolerance 63mW power, format 0603.	R141,R143, R151,R153
164	2	R_0603_200_1%	200 resistor 1% tolerance 63mW power, format 0603.	R74,R160
165	1	R_0603_243K_1%	243K ohms resistor 1% tolerance 63mW power, format 0603.	R282
166	1	R_0603_270K_1%	270K resistor 1% tolerance 63mW power, format 0603.	R184
167	2	R_0603_270_1%	270 resistor 1% tolerance 63mW power, format 0603.	R60,R157
168	3	R_0603_470K_1%	470K resistor 1% tolerance 63mW power,	R169-R171

			format 0603.	
169	1	R_0805_1K_1%	1K ohm resistor 1% tolerance 100mW power, format 0805.	R304
170	1	R_0805_2K2_5%	2K2 resistor 5% tolerance 100mW power, format 0805.	R309
171	1	R_0805_10_1%	10 ohm resistor 1% tolerance 100mW power, format 0805.	R126
172	9	R_1206_820_5%_0.25W	820 ohm resistor 5% tolerance 250mW power, format 1206.	R268-R273,R277-R279
173	1	R_2512_0R18_5%	0.18 ohm resistor 1W power, format 2512	R255
174	4	R1LP0408CSP-7LI	4Mbit SRAM CMOS memory (70ns) format SOP32 (RENESA).	U70,U75,U96,U102
175	1	SC28L92A1A	DUART (Doble Uart), format PLCC44 (Philips).	U54
176	4	SIEMENS_RTE24012	12V two commuted contacts relay of 8A, RTE24012 (Siemens)	K1-K4
177	1	SMBJ30A	30V Voltage supresor diode tension, 600W, format SMB(DO-214AA) (Fairchild).	D35
178	1	SN74HCT04AD	6 INVERTER gates I.C. SO14 (TI).	U85
179	2	SN74HC138AD	3 to 8 lines decoder I.C. SO16 (TI).	U36,U40
180	2	SN74HC244AD	2 Tri-state Buffers I.C. of 4 bit SOL20 (TI).	U48,U84
181	5	SN74HC259AD	C.I. Latch direccionable de 8 bit SO16 (TI).	U38-U39,U78,U81,U86
182	1	SN74LVC245APW	Bus transceiver I.C with Tri-state outputs TSSOP20 (TI).	U59
183	2	TLC2254CDG4	4 CMOS operational amplifies I.C with low power SO8 (TI).	U22,U68
184	2	TLMG3100	Green LED diode format SMD P-LCC-2 (VISHAY).	D22-D23
185	1	TLV5619CPW	DAC of 12 bits in pararell, format TSSOP20 (TI).	U51
186	1	TPS73025DBVT	2,5V/200mA Voltage regulator with low noise and High PSRR, Low-Dropout, format SOT23-5 (TI)	U99
187	8	TP_RND60_TAL32_CLR8	Test Point RND60_TAL32	TP0-TP7

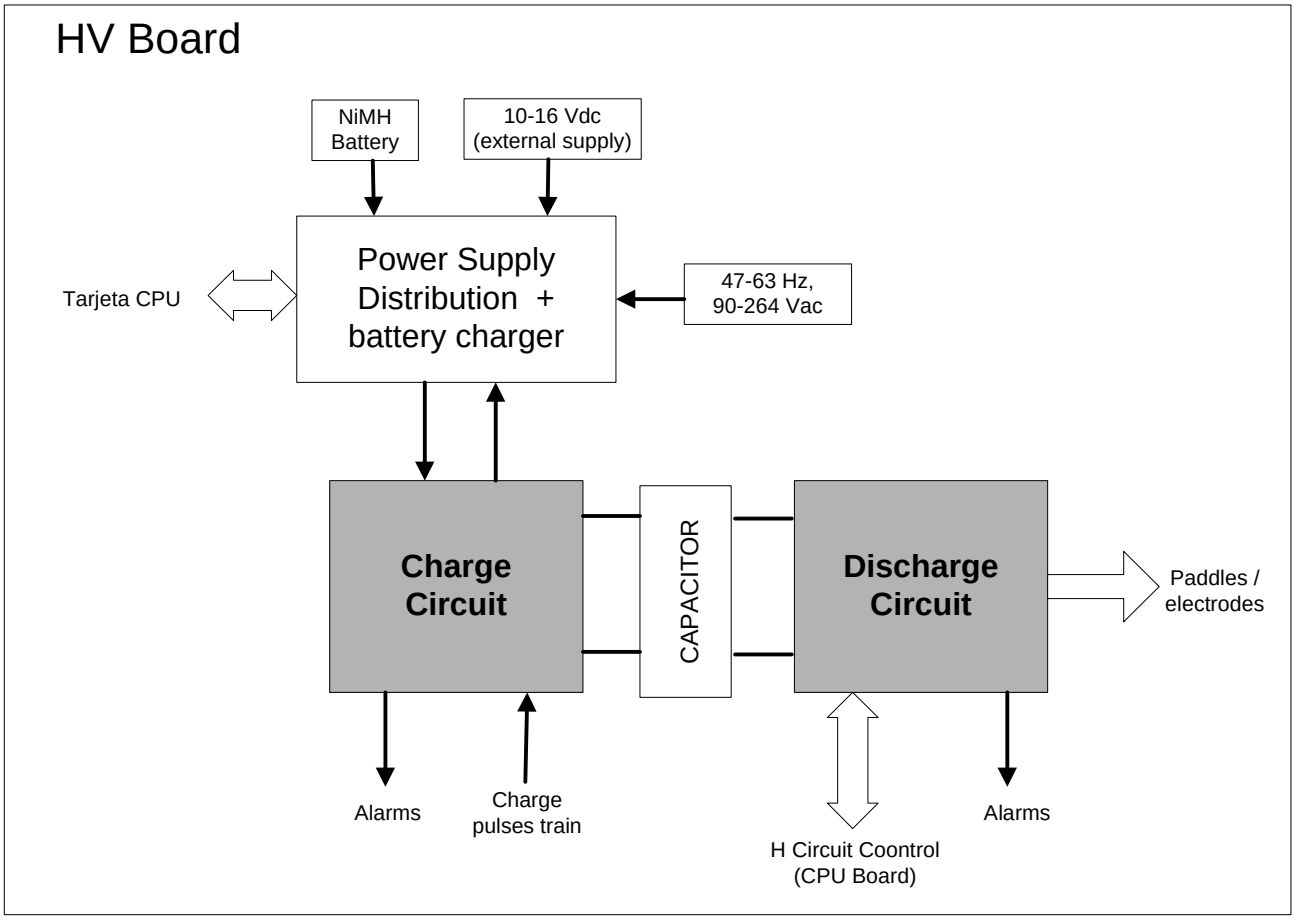
188	1	ULN2803LW	8 Darlington output array TTL/CMOS format SOL18 (ALLEGRO).	U83
189	1	VEA-25V471MH10-R	SMD Electrolitic capacitor 470uF/25V 20% (LELON).	C107
190	4	VZH-25V101MF80-R	Condensador electrolitico SMD 100uF/25V 20% Low ESR (LELON)	C203,C213, C216-C217
191	1	W681310RG	PCM Codec-Filter of 3V, format SSOP20 (WINBOND).	U45
192	1	XC3S100E-4VQ100C	FPGA of 100k in sistem gates format VQ100 (XILINX).	U60
193	1	XC6201P182M	Voltage regulator 1.8V low drop-out format SOT23-5 (TOREX).	U56
194	2	XC9536-10VQ44C	34 MacroCell CPLD, 10 ns, powered with 5V, format VQ44 (XILINX)	U37,U52
195	1	XC9536XL-10VQ44C	34 MacroCell CPLD, 10 ns, powered with 3,3 V, format VQ44 (XILINX)	U57
196	1	X9313WS	10 K digitally controlled potenciometer with 32 steps format SO8 (XICOR)	U2
197	2	ZXM61P02F	P-channel MOS transistor in enrichment mode, format SOT23 (ZETEX).	Q7-Q8
198	1	3M_D7E50-7316-02	CompactFlash extractor with low profile (3M).	J35
199	1	3M_N7E50-7516-VY-20	CompactFlash connector with low profile (3M).	J35
200	3	74LCX244WM	2 Buffers Tri-state I.C of 4 bit SOL20 (TI).	U95,U104-U105
201	2	74LCX245WM	Bus Tranceiver I.C. with Tri-state outputs SOL20 (Fairchid).	U94,U103
202	166	0603YC104KAT2A	SMD Capacitor 0603 X7R 100nF/16V 10% (AVX)	C1,C8-C10,C12,C15,C18,C21, C25-C26,C28,C40,C42,C45, C47,C51,C58-C61,C68-C71,C83-C85,C93-C95,C100-C103,C105, C108,C110-C111,C115-

				C116,C122, C124,C127-C134,C136, C138,C144-C146,C148-C150,C153, C155-C159,C161, C168-C169,C173, C176,C179-C182,C185-C187,C189-C192,C194, C196-C197,C199, C201,C206, C208-C212,C214-C215,C218, C223-C224,C226-C227,C236, C238-C241,C244, C246,C248-C249,C251-C255,C257-C259,C262-C268,C270-C273,C282-C284,C289, C291-C293,C296-C328
203	9	0805ZC105KAT2A	SMD Capacitor 0805 X7R 1uF/10V 10% (AVX)	C167,C172, C198,C207, C276,C278-C279,C281, C287
204	2	1206YC105JAT2A	SMD Capacitor 1206 X7R 1uF/16V 5% (AVX)	C82,C225
205	4	1206YC105KAT2A	SMD Capacitor 1206 X7R 1uF/16V 10% (AVX)	C3,C141,C143,C242
206	1	2238-586-15638	SMD Capacitor 0603 X7R 15nF/50V 10% (PHYCOMP)	C88
207	2	2238-786-19754	SMD Capacitor 0603 Y5V 220nF/16V -20+80% (PHYCOMP)	C19,C56
208	10	2350-521-91001	HRC11 Resistor 100M, 5%, 125mW, 0805 (PYHCOMP).	R216-R222,R224-R226

209	1	2468-2061	6-pins SMD straight male connector pitch 2.54 (CENVALSA).	J29
210	2	2468-2081	8-pins SMD straight male connector pitch 2.54 (CENVALSA).	J38-J39
211	14	06035A101JAT2A	SMD Capacitor 0603 NP0/C0G 100pF/50V 5% (AVX)	C11,C13-C14,C16-C17,C41,C43-C44,C46,C48,C53-C54,C86,C222
212	20	06035C103KAT2A	SMD Capacitor 0603 X7R 10nF/50V 10% (AVX)	C29,C63-C64,C72,C76-C77,C92,C98,C140,C160,C164,C178,C188,C193,C205,C220,C269,C280,C286,C294
213	4	06035C222KAT2A	SMD Capacitor 0603 X7R 2,2nF/50V 10% (AVX)	C31,C36,C90,C97
214	1	06035C472KAT2A	SMD Capacitor 0603 X7R 4.7nF/50V 10% (AVX)	C39
215	2	12063C474KAT2A	SMD Capacitor 1206 X7R 470nF/25V 10% (AVX)	C290,C295
216	1	87832-1420	14 –pins SMD straight male connector, pitch 2mm, without lead (MOLEX).	J1

7. High Voltage Board (HV)

7.1 Block diagram



Block diagram: High voltage Board

7.2 Description

The High Voltage Board (HV) mainly carries out the following functions:

- Charge and discharge of the defibrillation capacitor
- Control of the supply to the unit
- Battery charger

7.2.1 Charge and Discharge Process

In order to ascertain the necessary charge voltage, the energy selected by the user and the patient impedance must be known, so that depending on these according the capacitor can be charged as required.

The capacitor is charged via a sequence of pulses that allows the capacitor to reach the energy required. The frequency of this sequence is controlled by the capacitor voltage (signal between 0 and 5 volts).

When an overrun is detected in the level of energy required, charging is stopped and the capacitor discharges internally, giving an error indication. As the charge is dependant on this signal, in the event of a breakdown in the microprocessor for whatever reason, a warning might not be given, but there would be no discharge.

The energy of the positive and negative phases of the biphasic waveform are dependent on patient impedance.

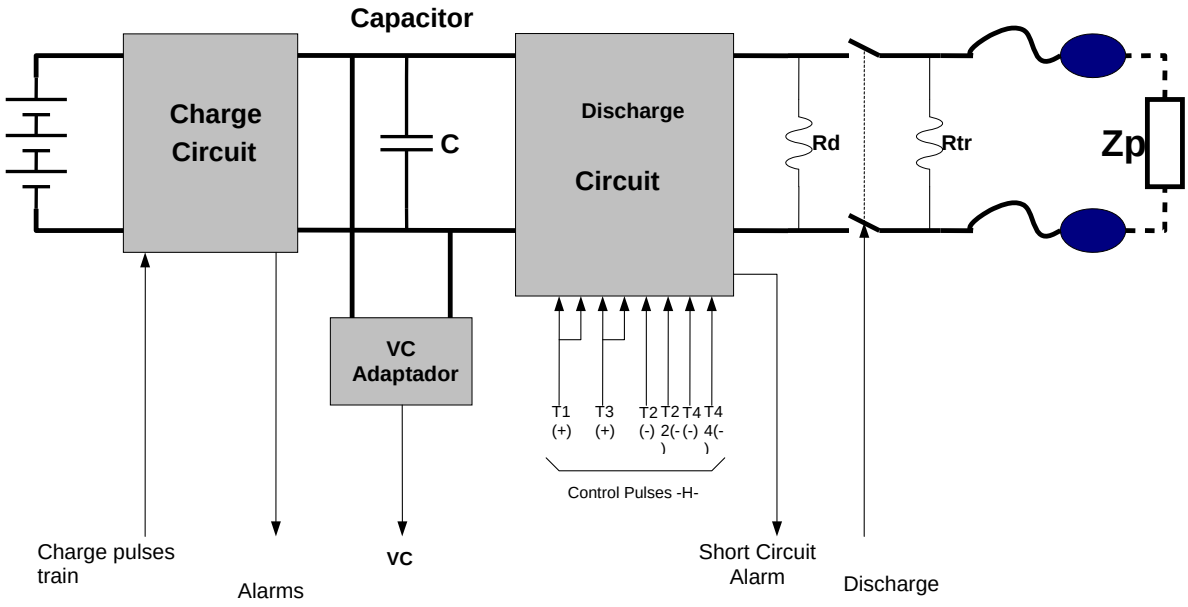
Once the capacitor has been been charged, if after 15 seconds in Semiautomatic Defibrillator mode, or 60 seconds in Manual Defibrillator mode, the SHOCK has not been carried out on the patient, the above mentioned energy is internally discharged. The equipment maintains the capacitor charge during all this time interval, recharging if necessary the energy lost due to the self-discharge of the main capacitor. In this way it ensures that the energy given the patient is always within the established limits (±15% or ± 3 Joules).

Before beginning charging and once this is completed, the impedance of the patient is monitored.

If the unit is operating with multifunction disposable electrodes and the impedance measured, before starting to charge, is greater than 2800 Ω (open circuit) or less than 15 Ω (short circuit), it will not be allowed charge the energy giving an on-screen message that the electrodes should be checked. If, once the energy has been charged and before proceeding to shock the patient, the value of the measured impedance is greater than 2800 Ω or less than of 15 Ω, the energy internally discharges, providing notification of what has occurred.

In the case of working with reusable paddles the unit will allow charging of the energy without the patient being connected, nevertheless if a short circuit is detected in these paddles charging of the energy will not be permitted.

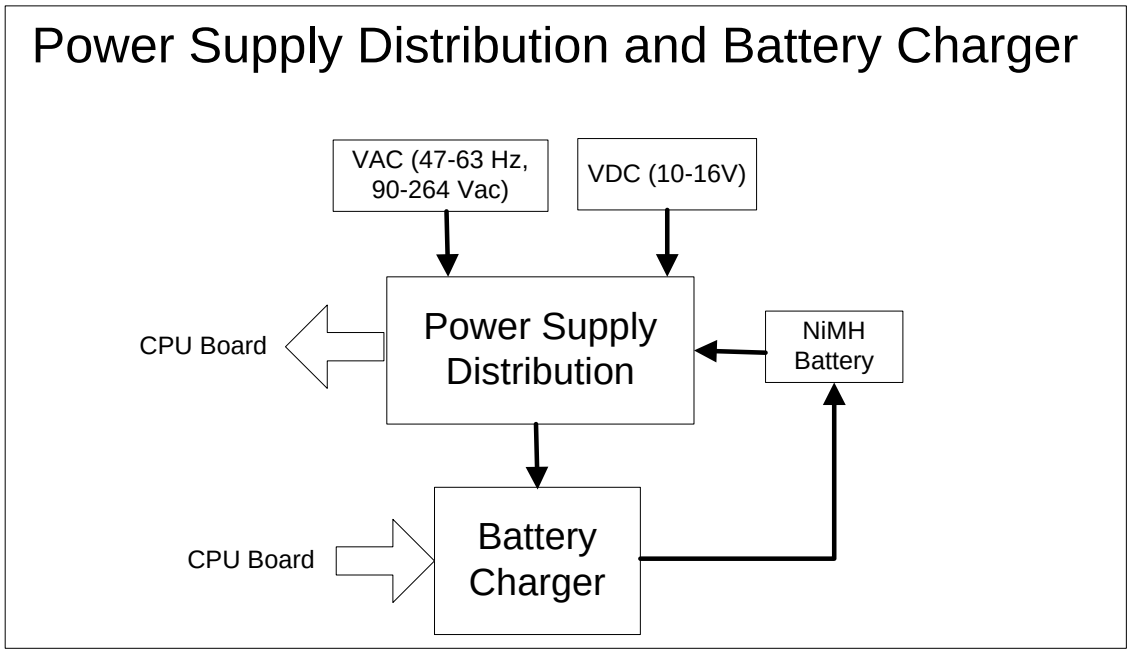
Once the energy has been charged, and before proceeding to shock the patient, the value of the impedance of the patient will also be verified, in order to determine if the shock can continue or not.



Block diagram: Charge/Discharge Circuit

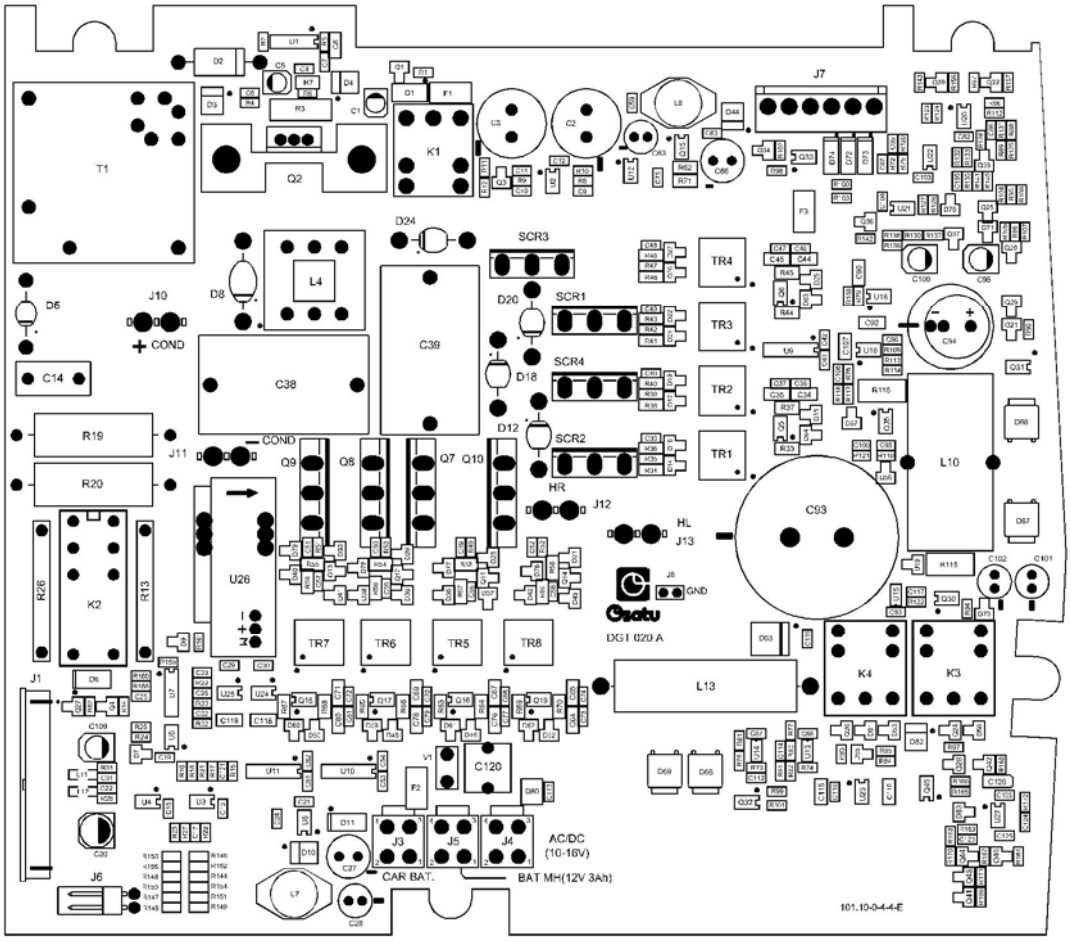
7.2.2 Power Supply Distribution and battery charger

This part of the unit is in charge of controlling supply to the unit, and of carrying out charging of the NiMH battery when this is installed in the unit, which is in turn connected to an external alternating power supply (47-63Hz, 90-264 Vac) or direct (10-16 Vdc). Charging of the NiMH battery is carried out independently of whether the REANIBEX 700 Series is switched on or switched off.



Block Diagram: Power Supply distribution and battery charger

7.3 Location of Components



DIBUJADO:	REVISADO:	ESCALA / CANT.	**Location of components HV Board**	Osatu, s. coop.
ANULA A / FECHA:			DENOMINACION:	CODIGO:

7.4 List of Materials

ITEM	QTY	PART NUMBER	DESCRIPTION	REFERENCES
1	1	AD822BR	I.C. Operational amplifier of one power supply and FET input low power, SO8 (AD).	U4
2	1	ARW_SH_112D	12V Relay one commuted contact 15A with doubles pins	K1
3	2	BAS16	Rapid diode Ifrm=500mA, Vr=75V, format SOT23 (PHILIPS).	D7,D9
4	1	BAT54S	Double rapid diode in series If=200mA, Vr=30V, format SOT23 (PHILIPS).	D75
5	1	BAT754	SCHOTTKY diode Ifrm=200mA, Vr=30V, format SOT23 (PHILIPS).	D81
6	9	BAV70	Double rapid diode in anti-series Ifrm=450mA, Vr=70V, format SOT23 (PHILIPS).	D53,D55-D58,D76-D79
7	16	BAV99	Double rapid diode Ifrm=450mA, Vr=70V, format SOT23 (PHILIPS).	D14,D16-D17,D19, D21-D22 D26-D27 D36-D43
8	1	BAV199	Double rapid diode in series If=200mA, Vr=70V, format SOT23 (ST).	D83
9	6	BC807	PNP Transistor format SOT23	Q11-Q14 Q29,Q44
10	17	BC817	NPN transistor with format SOT23.	Q1,Q4, Q20-Q22 Q24-Q28 Q36-Q37 Q39-Q43
11	1	BQ2002TSN	Batteries charger fomat SO8 (TI)	U20
12	4	BYM26G	Rapid and hight voltage diode , Vrrm=1400V, If=2.4A format SOD64 (Philips).	D12,D18, D20,D24
13	1	BYX90G	Rapid and hight voltage diode, Vrrm=7500V, If=0.55A format SOD83A (Philips).	D8
14	2	BZX84C_9V1	Zener diode 9.1V 0.3W, format SOT23 (PHILIPS).	D70-D71

15	12	BZX84C_10V	Zener diode 10V 0.3W, format SOT23 (PHILIPS).	D15,D25, D46,D48, D50,D52, D59-D64
16	4	BZX84C_18V	Zener diode 18V 0.3W, format SOT23 (PHILIPS).	D28-D31
17	1	B32560-J1225-K	Epcos poliester capacitor 2.2uF/63V 10% B32560-J1225-K	C120
18	1	B82111-B-C21	Bobine 5uH 10Amp (EPCOS)	L13
19	1	CENVALSA_2532-2021	Right angle male connector of 2 pins raster 2.54 (CENVALSA).	J6
20	1	CENVALSA_3951-2061	Straight male connector of 6 pins squared 1.14mm, pitch 3.96mm (CENVALSA).	J7
21	1	CPV-E25/13/7-1S-6P	Bobine NUCTOR 90 uH, Ref. ML-23179	L4
22	4	CS 45-16io1	SCR of 40A 1600V, format TO-247AD (IXYS)	SCR1-SCR4
23	2	C_P_ELER_2200uF_16V_20%	Panasonic electrolitic radial capacitor 2200uF/16V 20% ECA1CM222	C2-C3
24	1	C_S_ELER_1uF_50V_20%	SMD Panasonic electrolitic capacitor 1uF/50V 20% ECEV1HA010SR	C1
25	1	C_S_ELER_2.2uF_50V_20%	SMD Panasonic electrolitic capacitor 2.2uF/50V 20% ECEV1HA2R2SR	C5
26	3	C_S_ELER_10uF_25V_20%_D5	SMD Panasonic electrolitic capacitor 10uF/25V 20% ECEV1EA100SR	C95,C106, C109
27	1	C_S_ELER_47uF_25V_20%	SMD Panasonic electrolitic capacitor 47uF/25V 20% ECEV1EA470WP	C20
28	1	C_S_NP0_10nF_25V_5%_1206	SMD capacitor 1206 NP0 10nF/25V 5%	C8
29	2	C_S_NP0_56pF_25V_10%_0805	SMD capacitor 0805 NPO 56pF/25V 10%	C97-C98
30	1	C_S_TAN_1uF_16V_10%	SMD capacitor FT-A tantalo 1uF/16V 10% FTA.	C126
31	10	C_S_X7R_1nF_50V_10%_0603	SMD capacitor 0603 X7R 1nF/50V 10%	C22,C55-C58,C108, C111-C114

32	16	C_S_X7R_1uF_16V_10%_1206	SMD capacitor 1206 X7R 1uF/16V 10%	C34-C35 C44-C45 C64-C65 C67,C69, C71,C76, C78,C80, C90,C92, C107,C115
33	2	C_S_X7R_2.2nF_50V_10%_0603	SMD capacitor 0603 X7R 2.2nF/50V 10%	C10,C26
34	7	C_S_X7R_10nF_50V_10%_0603	SMD capacitor 0603 X7R 10nF/50V 10%	C9,C17, C31-C32 C86,C121, C125
35	6	C_S_X7R_22nF_50V_10%_0603	SMD capacitor 0603 X7R 22nF/50V 10%	C11,C23, C49-C52
36	4	C_S_X7R_33nF_50V_10%_0805	SMD capacitor 0805 X7R 33nF/50V 10%	C33,C40, C43,C48
37	1	C_S_X7R_47nF_50V_10%_0805	SMD capacitor 0805 X7R 47nF/50V 10%	C117
38	43	C_S_X7R_100nF_50V_10%_0805	SMD capacitor 0805 X7R 100nF/50V 10%.	C4,C7,C12-C13,C15, C19,C21, C24-C25 C29-C30 C36-C37 C41-C42 C46-C47 C53-C54 C59-C62 C68,C70, C72-C75 C77,C79, C81-C83 C87-C88 C103-C105 C110, C122-C124
39	3	C_S_X7R_330nF_25V_10%_1206	SMD capacitor 1206 X7R 330nF/25V 10%	C116,C118-C119
40	2	C_S_X7R_330pF_25V_10%_0805	SMD capacitor 0805 X7R 330pF/25V 10%	C99-C100
41	1	C_S_X7R_680pF_25V_10%_0805	SMD capacitor 0805 X7R 680pF/25V 10%	C6
42	1	C_S_X7R_1800pF_25V_10%_0805	SMD capacitor 0805 X7R 1800pF/25V 10%	C96

43	1	C_T_CER_4.7nF_3150V_+80-20%	Hight voltage ceramic capacitor 4.7nF 3150V +80,-20%, ref.DEBE33F472ZA3B (muRata)	C14
44	2	C_T_ELER_100uF_25V_20%_LESR	Radial electrolitic capacitor 100uF/25V 20% LOW ESR	C28,C63
45	2	C_T_ELER_220uF_25V_20%_LESR	Radial electrolitic capacitor 220uF/25V 20% LOW ESR	C27,C66
46	1	C_T_ELER_1000uF_35V_20%	Radial electrolitic capacitor 1000uF/35V 20%.	C94
47	1	C_T_ELER_10000uF_25V_20%	Radial electrolitic capacitor with snap-in 10000uF/25V 20%	C93
48	2	C_T_MKP_330nF_1250V_5%	Cond. MKP of 330nF 1250Vdc 5%, body of 28x31.5mm and raster of 27.5mm, (SIEMENS B32654-A7334-J).	C38-C39
49	1	DO3316P-223	SMD power bobine COILCRAFT. 22uH	L8
50	1	DO3316P-473	SMD power bobine. COILCRAFT. 47uH	L7
51	4	FASTON_V_6.35	FASTON vertical connector of 1 pin (AMP)	J10-J13
52	1	FCI_SFW30R-1ST	FFC right angle connector of 30 pins raster 1 lower contact (FCI).	J1
53	4	FGL60N170D	Chanel N IGBT with anti-paralel ultra-rapid diode Vce=1700V, Ic=60A, format TO-264 (Fairchild).	Q7-Q10
54	3	HEF4104BT	I.C. Converter from low to high voltage cuadruple with tri-state outputs, format SO16 (PHILIPS)	U9-U11
55	2	HFKS012-1ZS	12V Realy 1 contact with 10ª common output, (Hongfa)	K3-K4
56	6	IRF7309	Two mosfet of N and P chanels each, of very low resistor in ON, format SO8 (IR)	Q5-Q6 Q16-Q19
57	1	LAH 100-P	Hall effect LEM	U26
58	1	LMC6042IM	I.C. de 2 CMOS operationa amplifiers of low power SO8 (NS)..	U5
59	1	LMC6482IM	I.C. of 2 operationa amplifiers CMOS SO8 (NS).	U2
60	1	LMC6484IM	I.C. of 4 operationa amplifiers CMOS SO14 (NS).	U7

61	3	LMV321M5	Low voltage operational amplifier, format SOT23-5 (NS)	U13-U15
62	1	LMV358M	Low voltage operational amplifier, format SO8 (NS)	U22
63	1	LM78L12ACM	12V Voltage regulator, 100mA format SO8 (NS)	U24
64	1	LM79L12ACM	-12V negative voltage regulator, format SO8 (NS).	U25
65	1	LP2951CMM	Ajustable voltage regulator, of 200mA and Ultra Low-Dropout, format SO8 (NS).	U16
66	1	MAX766CSA	I dc-dc of -15V voltage inversor or ajustable, format SO8 (Maxim).	U6
67	1	MAX772CSA	dc-dc of 15V voltage regulator or ajustable, format SO8 (Maxim).	U12
68	4	MBRD340	Schottky diode If=3 Amp, Vrrm=40V, format DPAK (ON).	D66-D69
69	1	MC78L05ACD	5V voltage regulator, format SO8 (MOT).	U23
70	1	MMBF170	MOS transistor of N chanel, format SOT23 (Fairchild).	Q3
71	3	MOLEX_44472-0454	Female straight connector de 2+2 pins, pitch 4.2mm (molex).	J3-J5
72	1	NE555D	Timer of Fmax = 500MHz, format SO8 (Philips).	U27
73	2	NFM3DCC102R1H3	EMI Filter of capacitor for direct voltage 1000pF (muRata)	L11-L12
74	1	NUCTOR_ML24008_9uH/9A	Toroidal bobine 9uH/9Amp from Nutor ref ML:24008	L10
75	1	OSATU_TET-126-A	Trafo NUCTOR from 12V to 1700V, Ref. ML-22883	T1
76	3	PMLL4148	Rapid diode Ifrm=450mA, Vr=75V, format SOD80 (PHILIPS).	D72-D74
77	1	PUENTE_AKS	Two pins bridge raster=2.54	J8
78	2	RS1J	Rectifier diode 1A Vrrm=600V Ifrm=10A, format Do214AC/SMA (Fairchild).	D1,D6
79	2	RUBYCON_25ZA47M6.3X7	Electrolitic capacitor ultra Low ESR 25ZA47M6.3X7 (Rubycon)	C101-C102

80	2	R_1_50M_7500V_1%	50Mohms high voltage radial resistor7500V 1% 1W, ref. HB1_50M0_FZRE (Meggitt CGS).	R13,R26
81	1	R_2_SMD_0R03_1%	0.03ohm SMD resistor sensor tolerance 1% power 2W, serie SMD_OARS-1 (WELWYN).	R3
82	2	R_6_10K_5%	10K resistor tolerance 5% power 6W, format W22 (Welwyn).	R19-R20
83	3	R_0603_0	0 ohm resistor power 63mW, format 0603.	R2,R28, R31
84	2	R_0603_1K_1%	1K resistor tolerance 1% power 63mW, format 0603.	R156-R157
85	1	R_0603_2K2_1%	2K2 resistor tolerance 1% power 63mW, format 0603.	R4
86	8	R_0603_4K7_1%	4K7 resistor tolerance 1% power 63mW, format 0603.	R1,R12, R14-R15 R18,R21-R23
87	1	R_0603_5K6_1%	5K6 resistor tolerance 1% power 63mW, format 0603.	R16
88	1	R_0603_8K2_1%	8K2 resistor tolerance 1% power 63mW, format 0603.	R121
89	11	R_0603_10K_1%	10K resistor tolerance 1% power 63mW, format 0603.	R5,R17, R49-R52 R123-R124 R158-R160
90	12	R_0603_10K_5%	10K resistor tolerance 5% power 63mW, format 0603.	R144-R155
91	1	R_0603_15K_1%	15K ohm resistor tolerance 1% power 63mW, format 0603.	R27
92	1	R_0603_20K_1%	20K resistor tolerance 1% power 63mW, format 0603.	R6
93	7	R_0603_47K_1%	47K resistor tolerance 1% power 63mW, format 0603.	R98-R103,R119
94	1	R_0603_100_1%	100 resistor tolerance 1% power 63mW, format 0603.	R11
95	2	R_0603_147K_1%	147K ohm resistor tolerance 1% power 63mW, format 0603.	R24-R25
96	1	R_0805_0	0 ohm resistor format 0805.	R125

97	4	R_0805_1K_5%	1K resistor tolerance 5% power 100mW, format 0805.	R94-R97
98	5	R_0805_1M_5%	1M resistor tolerance 5% power 100mW, format 0805.	R72-R76
99	3	R_0805_2K_1%	2K ohm resistor tolerance 1% power 100mW, format 0805.	R80-R81 R138
100	1	R_0805_2K2_5%	2K2 resistor tolerance 5% power 100mW, format 0805.	R106
101	1	R_0805_3K3_5%	3K3 resistor tolerance 5% power 100mW, format 0805.	R113
102	1	R_0805_3K48_1%	3K48 resistor tolerance 1% power 100mW, format 0805.	R132
103	12	R_0805_4K7_1%	4K7 ohm resistor tolerance 1% power 100mW, format 0805.	R82-R87 R90, R126-R128 R142-R143
104	5	R_0805_4K7_5%	4K7 resistor tolerance 5% power 100mW, format 0805.	R167-R171
105	2	R_0805_4K87_1%	4K87 ohm resistor tolerance 1% power 100mW, format 0805.	R77-R78
106	1	R_0805_5K6_5%	5K6 resistor tolerance 5% power 100mW, format 0805.	R122
107	1	R_0805_6.8_5%	6.8 ohm resistor tolerance 5% power 100mW, format 0805.	R117
108	1	R_0805_7K5_1%	7K5 ohm resistor tolerance 1% power 100mW, format 0805.	R139
109	1	R_0805_8K2_5%	8K2 resistor tolerance 5% power 100mW, format 0805.	R107
110	6	R_0805_10K_5%	10K ohm resistor tolerance 5% power 100mW, format 0805.	R108-R109 R112, R162-R164
111	1	R_0805_10K2_1%	10K2 ohm resistor tolerance 1% power 100mW, format 0805.	R88
112	1	R_0805_10K5_1%	10K5 ohm resistor tolerance 1% power 100mW, format 0805.	R133
113	1	R_0805_11K_1%	11K ohm resistor tolerance 1% power 100mW, format 0805.	R89

114	4	R_0805_47K_5%	47K resistor tolerance 5% power 100mW, format 0805.	R140-R141 R165-R166
115	1	R_0805_56K_5%	56K resistor tolerance 5% power 100mW, format 0805.	R120
116	1	R_0805_56R2_0.1%	56R2 ohm resistor tolerance 0.1% power 100mW, format 0805.	R161
117	1	R_0805_68K_5%	68K resistor tolerance 5% power 100mW, format 0805.	R79
118	2	R_0805_68_5%	68 ohm resistor tolerance 5% power 100mW, format 0805.	R104-R105
119	5	R_0805_100K_1%	100K ohm resistor tolerance 1% power 100mW, format 0805.	R91-R92 R130-R131 R135
120	2	R_0805_100_1%	100 ohm resistor tolerance 1% power 100mW, format 0805.	R118,R137
121	6	R_0805_162K_1%	162K ohm resistor tolerance 1% power 100mW, format 0805.	R8-R10 R29-R30 R32
122	1	R_0805_470_5%	470 ohm resistor tolerance 5% power 100mW, format 0805.	R114
123	1	R_0805_560K_5%	560K resistor tolerance 5% power 100mW, format 0805.	R172
124	2	R_1206_0R09_1%_0.25W	0.09 ohm resistor tolerance 1% power 250mW, format 1206.	R62,R71
125	4	R_1206_2K2_1%_0.25W	2K2 resistor tolerance 1% power 250mW, format 1206.	R57-R60
126	1	R_1206_18_1%_0.25W	18 ohm resistor tolerance 1% power 250mW, format 1206.	R7
127	8	R_1206_56_1%_0.25W	56 ohm resistor tolerance 1% power 250mW, format 1206.	R34-R35 R38-R39 R41-R42 R46-R47
128	4	R_1206_100_1%_0.25W	100 ohm resistor tolerance 1% power 250mW, format 1206.	R36,R40, R43,R48
129	12	R_1206_470_1%_0.25W	470 ohm resistor tolerance 1% power 250mW, format 1206.	R33,R37, R44-R45 R63-R70

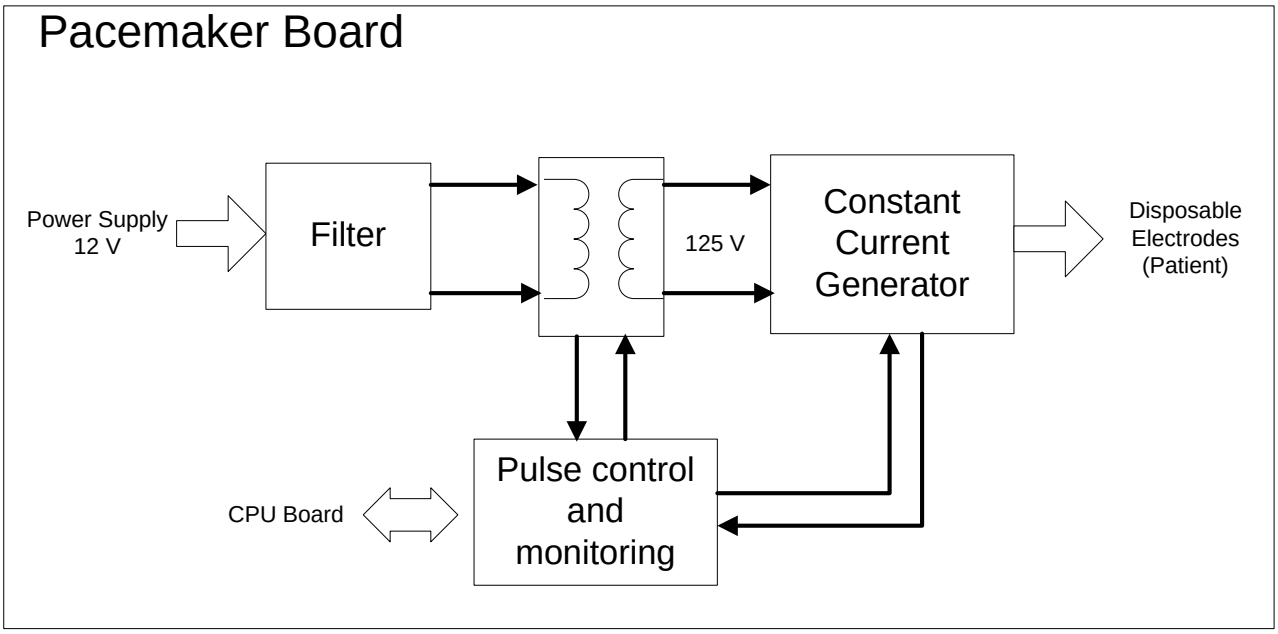
130	4	R_1206_560_2%_0.25W	560 ohm resistor tolerance 2% power 250mW, format 1206.	R53-R56
131	2	R_2512_0R047_1%	0.047 Resistor tolerance 1% power 1W, format 2512.	R115-R116
132	1	SHCV-SR2K20M105Z	Varistor VRMS=20V (EPCOS)	V1
133	1	SIEMENS_RTE24012	12V Raley two commuted contacts limpiable 8A, RTE24012 (Siemens)	K2
134	1	SI4420DY	MOS transistor of N chanel in enrichment mode, format SO8 (VISHAY).	Q35
135	5	SI4427DY	MOS transistor of P chanel in enrichment mode, format SO8 (VISHAY).	Q30-Q33 Q45
136	1	SI9410DY	MOS Transistor of N chanel in enrichment mode, format SO8 (VISHAY).	Q15
137	1	SMBJ18CA	Voltage supression diode 18V bidirectional, 600W, format SMB(DO-214AA) (Fairchild).	D80
138	1	SMBYW02_200	Rapid rectifier diode of hight eficiency, If=2 Amp, Vrrm=200V, format Do214AA/SMB (ST).	D3
139	1	SMCJ18A	Voltage supression diode 18V, 1500W, format SMC(DO-214AB) (ON).	D65
140	4	STPS340U	Schottky diode If=3 Amp, Vrrm=40V, format Do214AA/SMB (ST).	D4,D10,D44,D82
141	1	STP50NE10L	MOSFET Power transistor of N chanel Vds=100V, Id=50A, Rds(on)=0.021ohmn, format TO-220 (ST).	Q2
142	1	SW25-4	Radiator for TO 220 y 218 Rth=13 de REDPOINT_THERMALLOY_LTD	RD1
143	1	S1A	Controled avalanche Rectifier Diode 1Amp, format DO-214ªC (Philips).	D11
144	8	TECHNOLOGIES_78253/55 MV	Impulses transformator SMD 1:1.36, S=5V/5V, Iout=0.2A, V(aislamiento)=4000Vdc, Ref 78253/55MV (C&D)	TR1-TR8
145	1	TL2845-D8	PWM intensity controler format SO8 (TEXAS)	U18
146	2	TS372CD	I.C. Voltage double comparator, SO8 (ST)	U3,U21
147	1	UC3843BD	dc-dc converter pwm Current mode, format SO14 (Unitrode)	U1

148	1	WICKMANN_419_1800_000	SMD Fuse 8A, V=125V, P=1.3W, N-419 (WICKMANN)	F1
149	1	WICKMANN_419_2100_000	SMD Fuse 10A, V=125V, P=1.4W, N-419 (WICKMANN)	F2
150	1	WICKMANN_420_1250_000	SMD Fuse 2.5A, V=125V, P=0.4W, N-420 (WICKMANN)	F3
151	1	ZXCT1009F	Lout meter through Rshunt format SOT23 (ZETEX)	U19
152	2	ZXM61P02F	MOS Transistor P chanel in enriquecimiento, format SOT23 (ZETEX).	Q34,Q38
153	1	1N5372B	Zener diode 62V 5W, format DO201AE (FAGOR).	D2
154	1	1N6525	Hight voltage diode Vrv=5000V, If=125, format SOD57_R12.7 (VMI).	D5
155	1	DGT 020 A	I.C board of 4 layers thinkness 1.6mm class 4 of dificulty of LAB (101,10-0-4-4-E)	

Blank page

8. Pacemaker Board (Optional)

8.1 Block diagram



Block diagram: Pacemaker Board

8.2 Description

This board is entrustd with generating the stimulation pulses when operating in Pacemaker mode. The pulses emitted have a width of 40 msec, their amplitude can be varied from 5 to 150 mA in steps of 5 mA and the frequency of emission of the pulses can vary from 30 to 180 ppm in steps of 5 ppm.

Basically this board includes a constant current source that provides energy for the pulses a control section in charge of the supervision of the pulses emitted in order to ensure that they are correct.

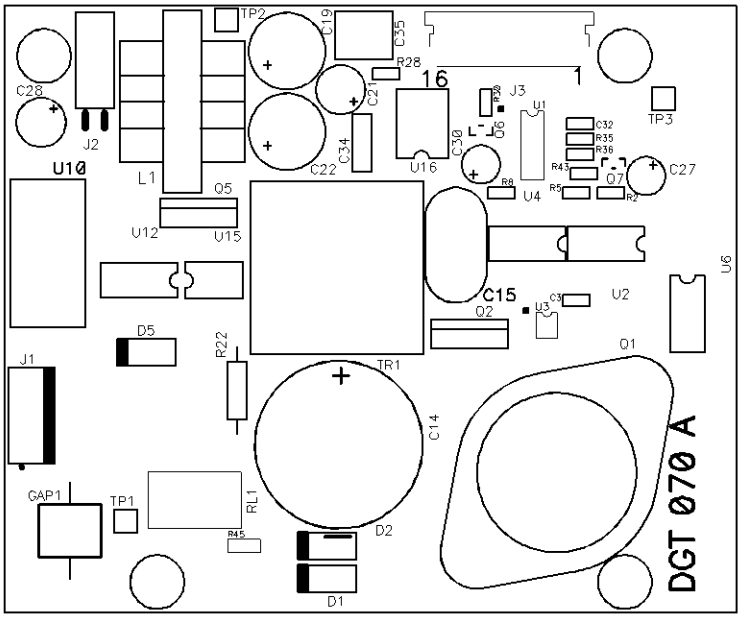
In this board the various protections that ensure that the pacemaker works correctly, avoiding risk for the patient, are implemented

- The amplitude of the pulses given to the patient is monitored in order to verify that it is appropriate. This information is sent to the CPU for its processing
- It implements a redundant control of the width of the pulses emitted, in order to ensure that in no case does this exceed 60 msec., even supposing that the main microprocessor of the CPU board becomes damaged.

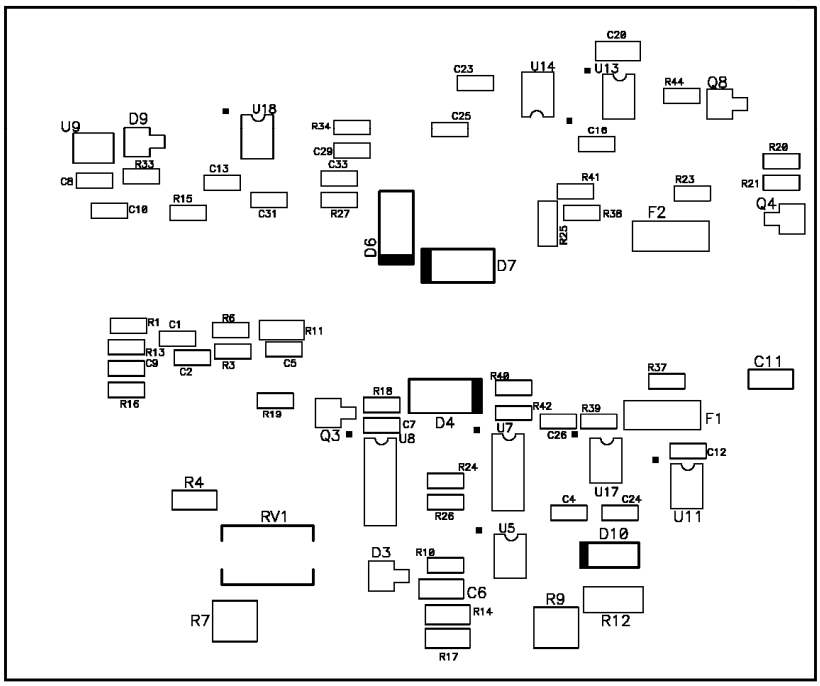
Control both of the stimulation frequency and of the amplitude of the pulses, is effected by the CPU Board. This board and specifically the main microprocessor, is that which indicates to the pacemaker board when it must emit a pulse, and what must be its amplitude.

Furthermore the pulses emitted are controlled in the CPU board by means of monitoring signals that come from the pacemaker board.

8.3 Location of Components



DIBUJADO:	REVISADO:	ESCALA / CANT.	Location of Components Pacemaker Board (I)	Osatu, s. coop.
ANULA A / FECHA:			DENOMINACION:	CODIGO:



DIBUJADO:	REVISADO:	ESCALA / CANT.	**Location of Components Pacemaker Board (II)**	Osatu, s. coop.
ANULA A / FECHA:			DENOMINACION:	CODIGO:

8.4 List of Materials

ITEM	QTY	PART NUMBER	DESCRIPTION	REFERENCES
1	6	M3	Washer M3	ARAN1, ARAN2, ARAN3, ARAN4, ARAN5, ARAN6
2	6	M3	Flat Washer M3	ARAN1, ARAN2, ARAN3, ARAN4, ARAN5, ARAN6
3	14	100nf	SMD capacitor 0805 X7R 100nF/25V 10%	C1,C2,C3, C4,C5,C7, C8,C13, C23,C24, C25,C29, C31,C32
4	1	1uf	SMD capacitor 1206 X7R 1uF/25V 10%	C6
5	2	27pf	SMD capacitor 0805 X7R 27pF/25V 10%	C9,C10
6	2	330nf	SMD capacitor1206 X7R 330nF/25V 10%	C20,C11
7	3	10nf	SMD capacitor 0805 X7R 10nF/25V 10%	C12,C16, C33
8	1	470uf	Radial electrolitic capacitor. Snap-In, raster 10 mm, Dia. 22 mm, Height = 25mm, 105ºC (470uF/160V)	C14
9	1	4,7nf	High voltage ceramic capacitor 4,7nf / 4Kv RMS, MURATA (DE1E3KX472MA5BA01)	C15
10	2	1000uf	Radial electrolitic capacitor raster 5 mm, Dia. 10 mm 85ºC (1000uF/25V)	C22,C19
11	2	100uf	Radial electrolitic capacitor raster 2.5 mm, Dia. 6.3 mm 105ºC (100uF/25V)	C28,C21
12	1	2,2nf	SMD capacitor 0805 X7R 2,2nF/25V 10%	C26
13	1	10uf	Radial electrolitic capacitor raster 2 mm, Dia. 5 mm 105ºC (10uF/35V)	C27

14	1	1uf	Radial electrolitic capacitor raster 2 mm, Dia. 5 mm 105ºC (1uF/50V)	C30
15	1	22nf	Capacitor MKT 22nF/100V, Raster 5mm EPCOS(B32529C1223K)	C34
16	1	1uf	Capacitor 1uf/63V AVX (BF074DO105K)	C35
17	2	1N5381B	Zener Diodo 1N5381B (130V / 5W)	D2,D1
18	2	BAV199	Diode BAV199, format SOT-23	D9,D3
19	1	MURS120T3	Diode MURS120T3, format SMB	D4
20	1	150V	Zener Diodo 150V 5W, 1N5383B	D5
21	1	1N5366B	Zener Diode 1N5366B (5W 39V)	D6
22	1	SMBYW02-200	Diode SMBYW02-200	D7
23	1	S1A	1 A rapid diode, S1A, format SMA	D10
24	1	375mA	Fuse 375mA, SMD (LITTELFUSE) R452.375	F1
25	1	2A	Fuse 2A, SMD (WICKMANN) 420-1200	F2
26	1	A81-A230X	Gas discharger A81-A230X	GAP1
27	1	PACIENTE	Straight male connector of 5 pins CENVALSA 2545-2051	J1
28	1	12V (IN)	Straight male connector of 2 pins CENVALSA 2532-2021	J2
29	1	HEADER 8X2	SMD right angle connector of 16 pins 52271-1690 (MOLEX)	J3
30	1	3.3mH	3.3mH Bobine, 2.2A, EPCOS B82732-R2222-B30	L1
31	1	MJ21193	PNP Transistor, MJ21193, format TO-3	Q1
32	1	MJE15032	NPN Transistor, MJE15032, format TO-220	Q2
33	4	BC817	BC817 Transistor	Q3,Q6,Q7, Q8
34	1	ZXM61P02F	ZXM61P02F Transistor	Q4
35	1	STP50NE10L	MOSFET transistor N chanel, STP50NE10L, format TO-220	Q5

36	1	G5V-1 12VDC	Relay Omron G5V-1 12VDC	RL1
37	1	150V	Varistor 150V, B72650M151K72	RV1
38	4	3K9	3K9 ohm resistor tolerance 5% power 100mW, format 0805	R1,R3,R6, R28
39	3	200R	200R ohm resistor tolerance 5% power100mW, format 0805	R2,R5,R8
40	1	100R	100 ohm resistor tolerance 5% power 250mW, format 1206	R4
41	2	22R	22R ohm resistor tolerance 5% power 1W, format 1218	R7,R9
42	1	100R	100 ohm resistor tolerance 5% power 100mW, format 0805	R10
43	1	470R	470 ohm resistor tolerance 5% power 250mW, format 1206	R11
44	1	47R	47R ohm resistor tolerance 5% power 1/2W, format 2010	R12
45	1	475R	475R ohm resistor tolerance 1% power 100mW, format 0805	R13
46	1	6R8	6R8 ohm resistor tolerance 5% power 1/4W, format 1206	R14
47	3	162K	162K ohm resistor tolerance 1% power100mW, format 0805	R15,R16, R18
48	1	10R	10R ohm resistor tolerance 5% power 1/4W, format 1206	R17
49	9	10K	10K ohm resistor tolerance 5% power 100mW, format 0805	R19,R20, R21,R26, R30,R35, R36,R43, R44
50	1	10K	10K ohm resistor tolerance 5% potencia 2W, format with legs	R22
51	1	560R	560R ohm resistor tolerance 5% power 100mW, format 0805	R23
52	1	820K	820K ohm resistor tolerance 5% power 100mW, format 0805	R24
53	1	0,047R	0.047R ohm resistor tolerance 1% power 250mW, format 1206	R25

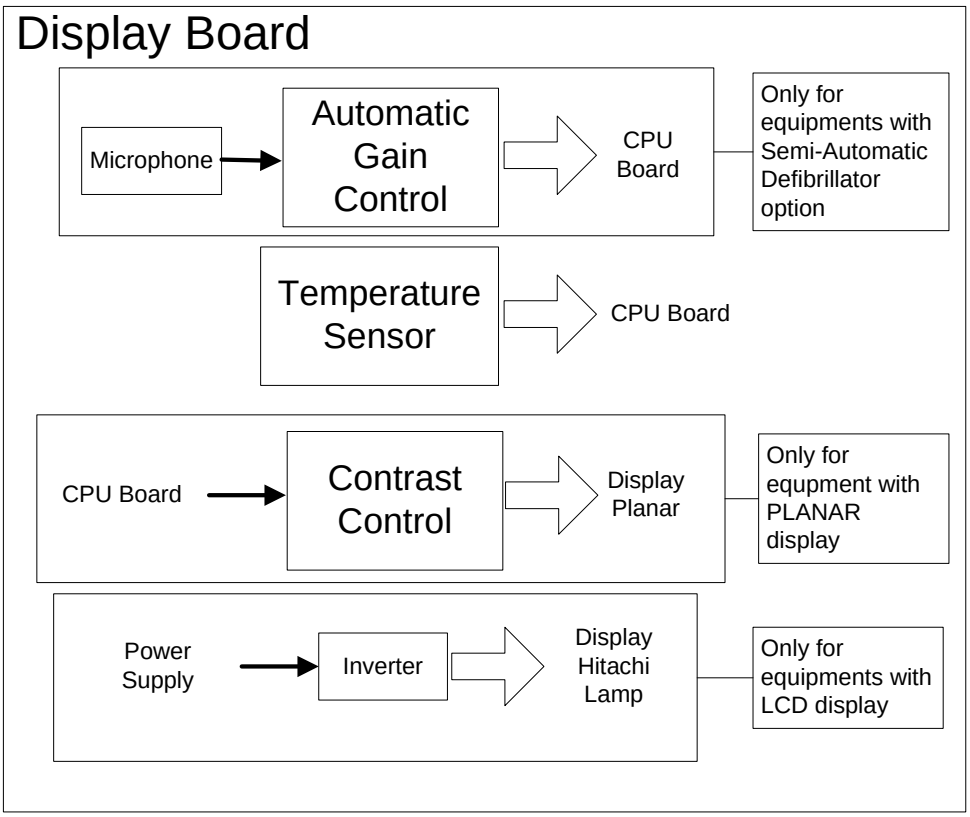
54	1	330R	330R ohm resistor tolerance 5% power 100mW, format 0805	R27
55	1	100K	100K ohm resistor tolerance 5% power 100mW, format 0805	R33
56	1	560K	560K ohm resistor tolerance 5% power 100mW, format 0805	R34
57	1	390R	390R ohm resistor tolerance 1% power 100mW, format 0805	R37
58	1	3K9	3K9 ohm resistor tolerance 1% power100mW, format 0805	R38
59	1	220R	220R ohm resistor tolerance 1% power 100mW, format 0805	R39
60	1	487K	487K ohm resistor tolerance 1% power 100mW, format 0805	R40
61	1	470R	470R ohm resistor tolerance 1% power 100mW, format 0805	R41
62	1	10K	10K ohm resistor tolerance 1% power 100mW, format 0805	R42
63	1	15R	6R8 ohm resistor tolerance 5% power 1/4W, format A DEFINIR	R45
64	4	M3x16mm	Plastic separatos male-female M3x16 mm (VSE 316 P)	SEP1, SEP2, SEP3, SEP4
65	2	M3x8	Alomada head screw M3 X 8mm (VTA 308 I)	TOR2, TOR1
66	3	GND	2 pins bridge raster de 2,54	TP1,TP2, TP3
67	14	TEST POINT	THEY ARE NOT COMPONENTS	TP4,TP5, TP6,TP7, TP8,TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17
68	1	TRAFO ML 23923	NUCTOR Transformer, ML 23923 edición 2	TR1

69	6	M3	M3 Nut (VNA 003 B)	TUER1, TUER2, TUER3, TUER4, TUER5, TUER6
70	1	MC74HC14AD	Inverter MC74HC14AD, format SMD	U1
71	2	HCPL-2630	Dual Optocoupler TTL compataible, HCPL-2630, format DIP8 (HP),	U2,U4
72	1	AD5300BRM	Integrated circuit AD5300BRM	U3
73	1	AD822AR	Integrated circuit AD822AR, format SOIC-8	U5
74	1	IL300-F	Optocoupler IL300-F	U6
75	1	LMC6484IM	Integrated circuit LMC6484IM, format SMD	U7
76	1	CD4052BCM	Integrated circuit CD4052BCM, format SMD	U8
77	1	LMV321	Integrated circuit LMV321M5	U9
78	1	NMJ0512S	DC/DC converter, NMJ0512S	U10
79	1	MC78L05ACD	Regulator MC78L05ACD, format SOIC-8	U11
80	1	PVD2352	Opto Relay PVD2352	U12
81	1	MC78L08ACD	Regulator MC78L08ACD, format SOIC-8	U13
82	1	MAX771ESA	Integrated circuit MAX771ESA, format SO8	U14
83	1	CNY17-3.300	Optocoupler CNY17-3.300, format Through hole	U15
84	1	4N26.S	Optocoupler 4N26.S, SMD format	U16
85	1	TL431	Reference voltage circuit TL431, format SO8	U17
86	1	NE555D	Integrated circuit NE555D, format SMD	U18
87	1	DGT 070 A	Board DGT 070 A	Z3

Blank page

9. Display Board

9.1 Block diagram



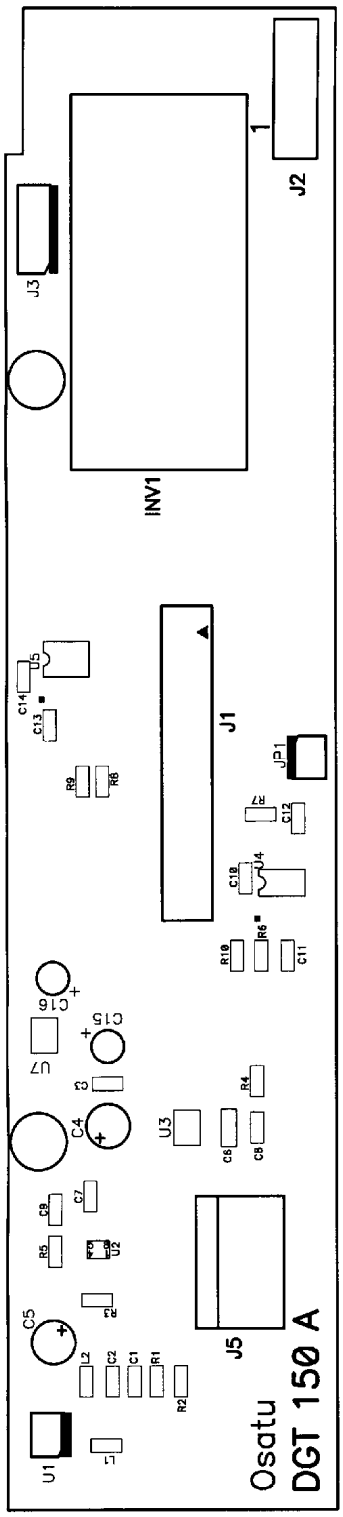
Block diagram: Display Board

9.2 Description

This board is located in the display block that contains the unit screen and a part of the keyboard (keyboard display). This card carries out the following functions:

- It holds the inverter necessary for the LCD type screen lamps
- It controls the contrast for the screens, depending on temperature
- It carries out the recording of external audio of the scene by means of a microphone positioned in this scene.
- It measures the ambient temperature by means of a temperature sensor
- It serves as interface between the keyboard display and the CPU board

9.3 Location of Components



DIBUJADO:	REVISADO:	ESCALA / CANT.	Location of components Display Board	Osatu, s. coop.
ANULA A / FECHA:			DENOMINACION:	CODIGO:

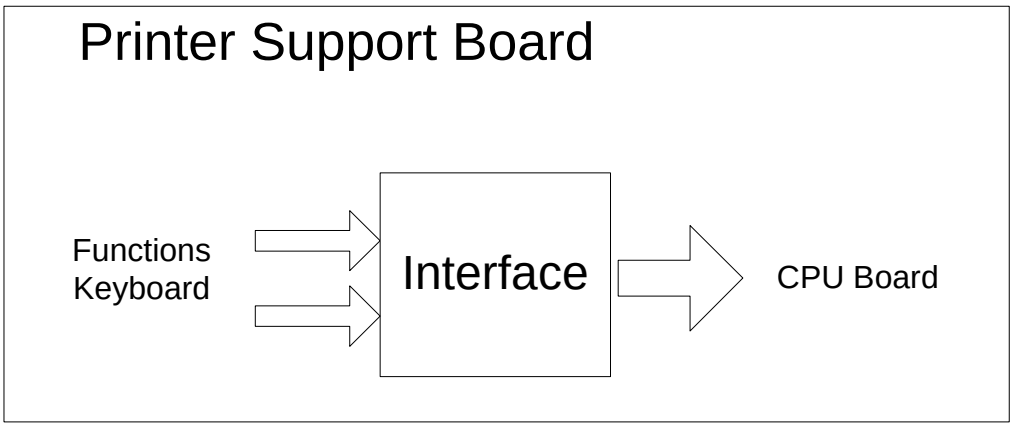
9.4 List of Materials

ITEM	QTY	PART NUMBER	DESCRIPTION	REFERENCES
1	2	470nf	SMD 0805 capacitor X7R 470nF/25V 10%	C7,C1
2	1	47nf	SMD 0805 capacitor X7R 47nF/25V 10%	C2
3	6	100nf	SMD 0805 capacitor X7R 100nF/25V 10%	C3,C8,C9, C10,C13, C14
4	1	10uf	10uf Electrolitic Radial capacitor	C4
5	1	1uf	1uf Electrolitic Radial capacitor	C5
6	1	1uf	SMD capacitor 1206 X7R 1uF/25V 10%	C6
7	2	10nf	SMD capacitor 0805 X7R 10nF/25V 10%	C12,C11
8	2	1uf	Capacitor 1uf Tantalo with legs	C15,C16
9	2	BYG21M	Power diode SMD BYG21M (VISHAY)	D1,D2
10	1	CXA-L10-L	Inverter LCD CXA-L10-L	INV1
11	1	DISPLAY PLANAR	Straight male connector Molex 2 pins polarized	JP1
12	1	SFW30S-2ST	30 pins FFC SMD connector pitch 1mm, SFW30S-2ST	J1
13	1	FFC/FPC	8 pins male FFC with legs,Molex 39-51-3084	J2
14	1	LAMPARA	Straight male connector Molex 4 pins polarized	J3
15	1	HEADER 6	Right angle male connector Nicomatic 6 pins polarized,	J5
16	1	Conector 2 pines	Straight male connector 5 pins CENVALSA 2545-2021	J6
17	2	FAIR-RITE-250805-6007-Z0	Bobine FAIR-RITE-250805-6007-Z0	L1,L2

18	2	10K	10K ohm resistor tolerance 1% power 100mW, format 0805	R1,R4
19	1	1K5	1K5 ohm resistor tolerance 1% power 100mW, format 0805	R2
20	2	33K	33K ohm resistor tolerance 1% power 100mW, format 0805	R3,R5
21	2	47K	47K ohm resistor tolerance 1% power 100mW, format 0805	R7,R6
22	2	390R	390R ohm resistor tolerance 1% power 100mW, format 0805	R8,R9
23	1	0R	0R ohm resistor tolerance 1% power 100mW, format 0805	R10
24	1	LD502	I.C. Audio LD502	U2
25	1	LMV321/SO	I.C. Operational LMV321M5	U3
26	1	LMC6042IM	I.C. Operational LMC6042IM	U4
27	1	DS1722S	Temperature Sensor I.C. DS1722S	U5
28	1	XC6201P182MR	Regulator XC6201P182MR de 1,8V	U7
29	1	DGT 150 A	Circuit board DGT 150 A	Z1

10.Printer Support Board

10.1 Block diagram

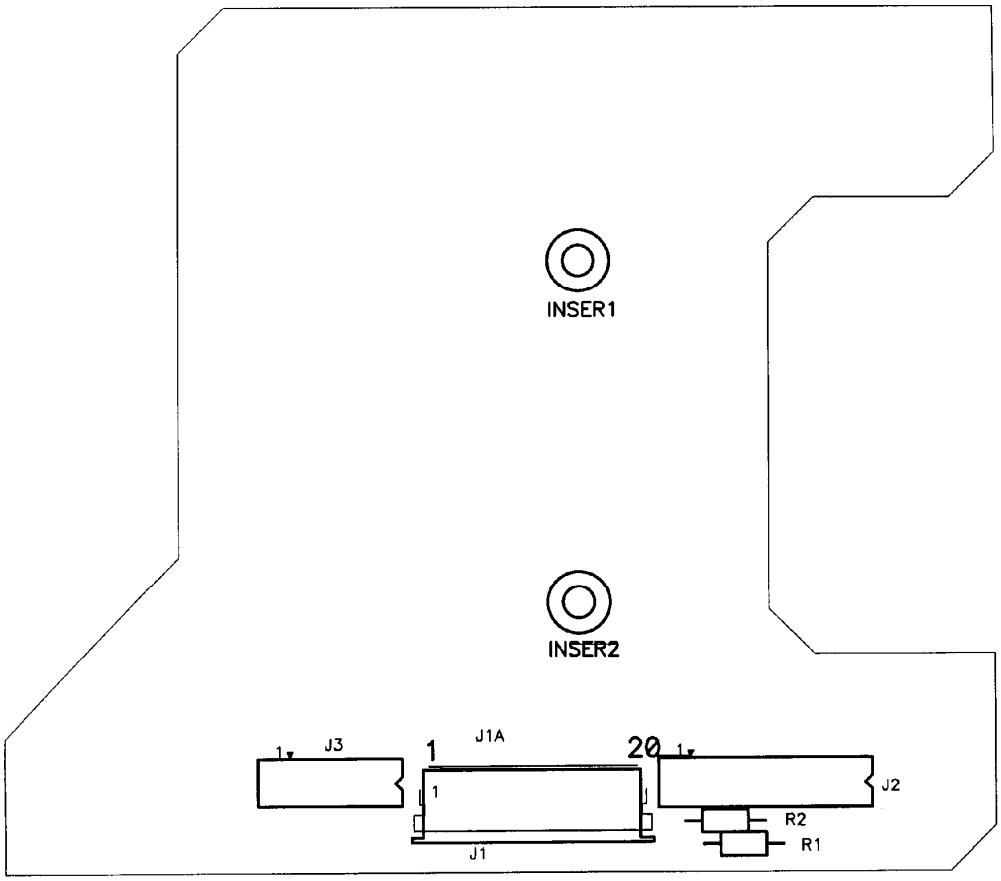


Block diagram: Printer support Board

10.2 Description

This board basically serves to physically support the unit recorder and to act as interface between the functions keyboard positioned in the front part of the unit and the CPU board entrusted with control of the unit.

10.3 Location of Components



DIBUJADO:	REVISADO:	ESCALA / CANT.	Location of components Printer Support Board	Osatu, s. coop.
ANULA A / FECHA:			DENOMINACION:	CODIGO:

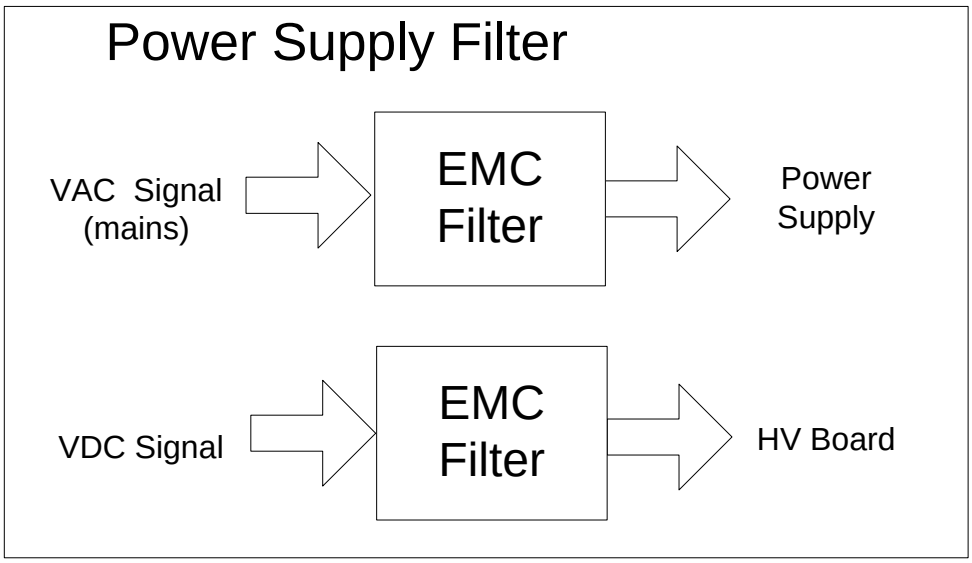
10.4 List of Materials

ITEM	QTY	PART NUMBER	DESCRIPTION	REFERENCES
1	1	HEADER 14	14 pins Vertical connector, FFC/FPC MOLEX (39-51-3144)	J2
2	1	HEADER 8	8 pins Vertical connector, FFC/FPC MOLEX (39-51-3084)	J3
3	1	HEADER 20	20 pins 1mm connector, 52043-2010 (MOLEX)	J4
4	2	820R	820R resistor 1/4 W 5% (through-hole)	R1,R2
5	2	INSERTO	Inserto of 9mm, (TEXTRON 01117-07090), (OSATU VNI 205 E)	Z1,Z2
6	1	DGT 030 A	Circuit board DGT 030 A	Z3

Blank page

11.Supplies Filter Board

11.1 Block diagram

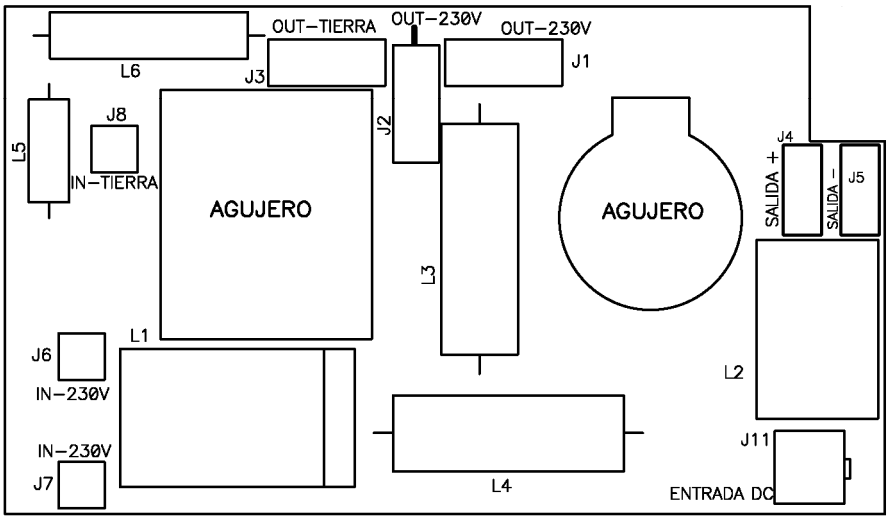


Block Diagram: Supplies Filter

11.2 Description

This board has two EMC filters for the input supply signals. There is one filter for the electrical mains signal (VAC) and another for the signal that comes from a constant external power supply (VDC).

11.3 Location of Components



DIBUJADO:	REVISADO:	ESCALA / CANT.	Location of components Power Supply Distribution Board	Osatu, s. coop.
ANULA A / FECHA:			DENOMINACION:	CODIGO:

11.4 List of Materials

ITEM	QTY	PART NUMBER	DESCRIPTION	REFERENCES
1	2	OUT-230V	Solded wire	J1,J2
2	1	OUT-TIERRA	Solded wire	J3
3	1	SALIDA +	Solded wire	J4
4	1	SALIDA -	Solded wire	J5
5	2	IN-230V	Solded wire	J6,J7
6	1	IN-TIERRA	Solded wire	J8
7	1	ENTRADA DC	44472-0454 female straight connector of 2+2 pins, pitch 4.2mm (molex)	J11
8	1	2X6,8mH	2X6,8mH Toroidal shock, RN 222-2/02, (ISCHAFFNER)	L1
9	1	2X1mH	2X1mH Toroidal shock, 7446223001, (WÜRTH ELEKTRONIK)	L2
10	2	120uH	120uH bobine, B82500-C-A10, (EPCOS)	L4,L3
11	1	6,8mH	6,8mH bobine, B82144-A2685-J, (EPCOS)	L5
12	1	680uH	680uH bobine, B82111-E-C28, (EPCOS)	L6

Blank page

12. Unit Self-Testing

The different self-tests that the unit runs, and their frequency, are given below:

	TYPE OF TEST			
	Switch On	**Operating**	**Start of module**	**Manual Test**
FLASH Memory	**YES**			**YES**
RAM Memory	**YES**			**YES**
DUART	**YES**			**YES**
RTC	**YES**			**YES**
Supply	**YES**			**YES**
INTERNAL Battery	**YES**	**YES**	**YES**	**YES**
Ambient Temperature	**YES**	**YES**	**YES**	**YES**
DEFIBRILLATOR				
Biphasic Pulse Maximum time	**YES**	**YES**	**YES**	**YES**
Capacitor Charge	**YES**	**YES**	**YES**	**YES**
Pulse Discharge	**YES**	**YES**	**YES**	**YES**
Charge Process	**YES**	**YES**	**YES**	**YES**
Disharge Process	**YES**	**YES**	**YES**	**YES**
PATIENT MONITOR				
ADμC Communication	**YES**	**YES**	**YES**	**YES**
A/D Converter	**YES**			**YES**
D/A Converter	**YES**			**YES**
PLD	**YES**			**YES**
Impedance Meter	**YES**			**YES**
Acquisition Circuit				**YES**
ECG Circuit				**YES**
Loose lead detection circuit				**YES**

COPROCESSOR				
Communication	**YES**	**YES**	**YES**	**YES**
Sound recording				**YES**
PACEMAKER				
Communication	**YES**	**YES**	**YES**	**YES**
125 V Source	**YES**	**YES**	**YES**	**YES**
Pacemaker pulse		**YES**		**YES**
Protections				**YES**
PULSE OXIMETRY				
Communications	**YES**	**YES**	**YES**	**YES**
RECORDER				
Communication	**YES**	**YES**	**YES**	**YES**
Status		**YES**	**YES**	**YES**
Test sheet				**YES**
PADDLES-PATIENT CABLE				
Detection	**YES**	**YES**	**YES**	**YES**
Test Complete				**YES**
COMPACT FLASH				
Communication	**YES**	**YES**	**YES**	**YES**
Space and status	**YES**	**YES**	**YES**	**YES**
Read/Write				**YES**

12.1 Description of the self-checks

Each of the self-checks and/or checks that the REANIBEX Series 700 performs in different tests that it carries out is described below (at start-up, while operating, at start up of the module and Test Hardware manuals):

1- **FLASH MEMORY -** Perform the standard CRC test, in order to verify the integrity of the memory. With this test the resources (Font and Texts) and the parameters of the unit are tested.

2- **RAM MEMORY -** The state of the RAM memory of the unit is checked

3- **DUART -** Communication with the DUART is checked

4- **RTC (Real Time Clock) -** It will be checked if it is possible to establish communication with the RTC and if there is an error in the format of its data.

5- **SUPPLY -** It tests the general supply of the unit. The value has to be kept pre-defined limits (10-16V). This supply refers to the DC_SENSE generated in the supplies commutator.

6- **INTERNAL BATTERY -** It tests the charge of the equipment internal battery which holds the data and the time of the RTC.

7- **Ambient TEMPERATURE -** The unit will measure the ambient temperature in which the equipment is placed, by means of the NTC positioned in the display board, giving the appropriate indication in the case it is outside of the operating limits (0-40ºC)

8- **DEFIBRILLATOR -** This verification includes the following test:

- **Maximum Pulse time** - Consists of verifying that the maximum time authorized alarm works correctly.
- **Process of Charge** - To verify that the capacitor has been charged to a determined voltage within the established time limits.
- **Discharge Process** - During this test, the discharge circuit is checked. Two possible situations can occur:
  - If the capacitor does not discharge it means that one of the branch components is in open circuit or that the lead circuitry does not work correctly.
  - If on the contrary the capacitor discharges rapidly, it means that part of the other branch is in short circuit, which would produce an alarm due to over-current.

- **Discharged energy and biphasic pulse phases time -** It verifies during the discharge, that the phase times of both the biphasic pulse and the discharged energy are within the established limits.

9- **PATIENT MONITORING -** Is entrustd with testing the part of the equipment in charge of monitoring the parameters of the patient.

- **COMMUNICATION with the ADuC -** The CPU tries series communication with the ADuC. If there is no response within a established time, it considers that it is not possible to establish communication and returns an error.
- **A/D and D/A CONVERTER -** In this test it is checked that the converters of the equipment work correctly.
- **Patient IMPEDANCE meter circuit -** By means of this Test the impedance measurement circuit is tested and calibrated.
- **ECG CIRCUIT Testing -** By means of this Test the impedance measurement circuit is tested and calibrated
- **LOOSE ELECTRODE DETECTION CIRCUIT -** This test checks that the loose electrode detection circuit works correctly, that is that it is capable of detecting this condition
- **Communication with the paddles** - The purpose of this test is to check the correct operation of the I2C bus that communicates with the paddles

10- **COPROCESSOR: Presence and communication**

The CPU tries to establish series communication with the coprocessor (COP_RXD0 and COP_TXD0). If it does not respond because it does not exist or there is some communication problem it will give an error.

11- **PACEMAKER -** During this test apart from comunication with the Pacemaker, the following points are tested:

- **125 V Source -** The control signal will be viewed to see if the source works or not.
- **Pulse current -** The current delivered trough a knwn test impedance is monitored to verify if it is the same to the one selected during the test.
- **Pulse time** - Checks that the duration of the pulse provided by the pacemaker is correct and does not exceed the established limits.

12- **SpO2 Card: Identification and communication -** To check if there is a SpO2 board, and in the case that there is, what board it is and if it is possible to establish communication with it.

13- **RECORDER: Presence and condition -**To check if there is or isn't a RECORDER and its status.

14- **PATIENT CABLE and PADDLES -**At start-up the presence of patient cable and paddles connected to the unit, and the type, will be detected and identified

15- **NiMH BATTERY: Presence and condition -** The V_BATT signal is viewed, to check the carge of the battery and to provide the corresponding indications.

16- **COMPACT FLASH: Presence and status -** If there is no coprocessor there will be no CF. In the case that there is, to check its status and the memory capacity that it still has for recording. Also it will check the capacity of the memory card.

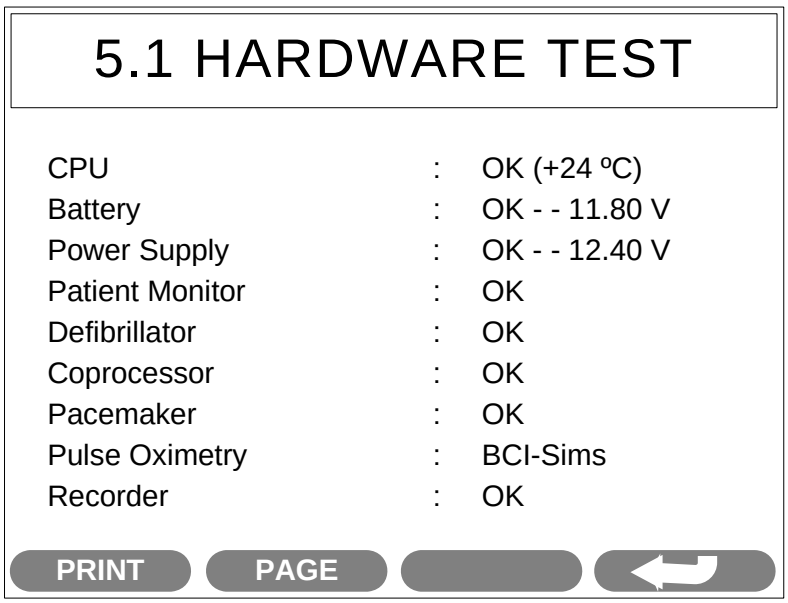
12.2 Hardware Test

This is a manual Test that is carried out on request of the user that enters Configuration mode.

By means of this test all the hardware elements of the system will be checked. If in a period of 30 days there has been no discharge, the equipment will indicate the need of carrying out a Hardware Test in order to check the condition of the equipment.

To execute this Test, it is necessary to enter the Configuration mode. For this it is necessary to switch the equipment on keeping pressed the MENU key  positioned in the lower part of the front panel of the unit. Once in Configuration mode, the option " 5. Test " is entered and within it, the option " 5.1 Test Hardware ".

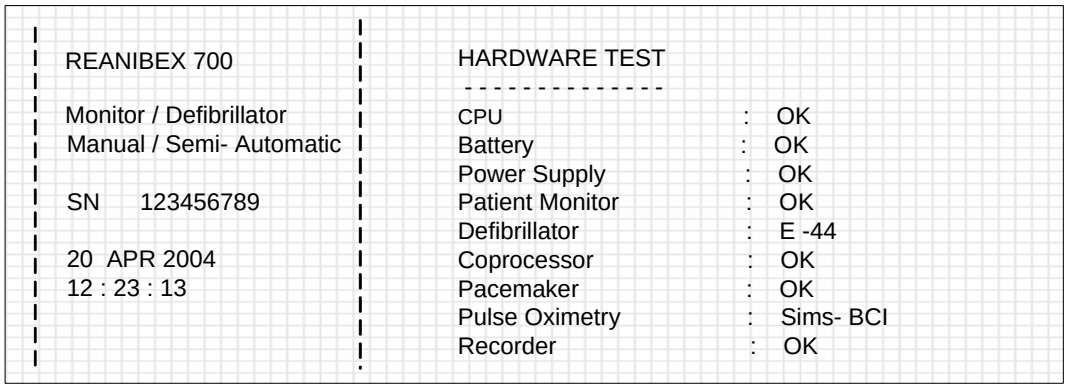
Once this option has been entered, by pressing the  key this test starts. As this is executed, on the screen of the unit the result of the different checks that comprise this test appear.



If an error is detected, it will be shown associated with the element in which it has detected the error code. If on the contrary the results of the checks performed are correct, an "OK", associated with each one of the elements, will be shown on-screen.

In addition, beside the CPU test, the value of the temperature measured by the sensor placed in the unit appears. In the case of the battery and supply there the value of voltage read appears. The value of the battery voltage will depend on its capacity.

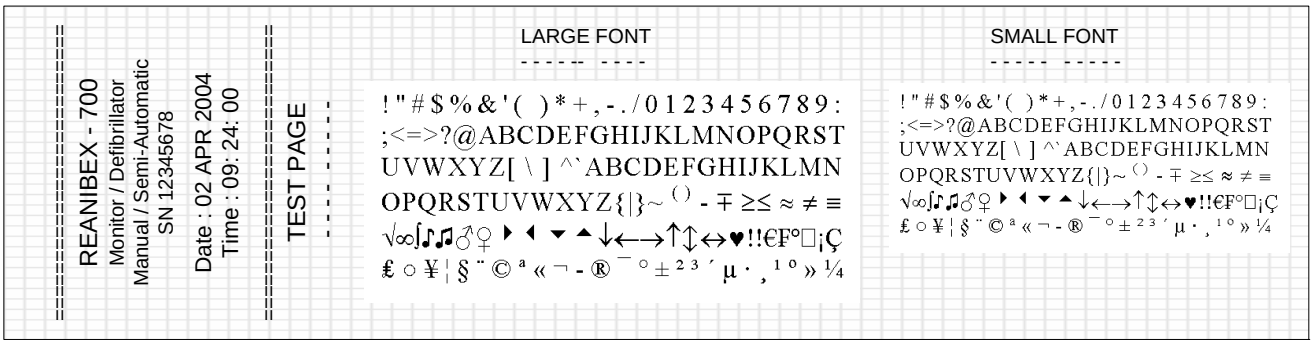
Once all the self-checks included in this section have been completed, the results of these can be printed on the unit recorder by means of the **PRINT** key located below the screen. The appearance of the printed results appears in the following figure:



It is recommended not to carry out this Test Hardware more than 5 consecutive times to avoid excessive temperatures in the test resistance located the interior of the unit. If it is required to

carry out this test more often, it is recommended to switch the equipment off for an interval of at least one hour.

If the " PAG " key is pressed and the recorder is operative, there a test sheet will be printed on it whose purpose is to ensure that it prints correctly. The appearance of the test sheet must be as follows:

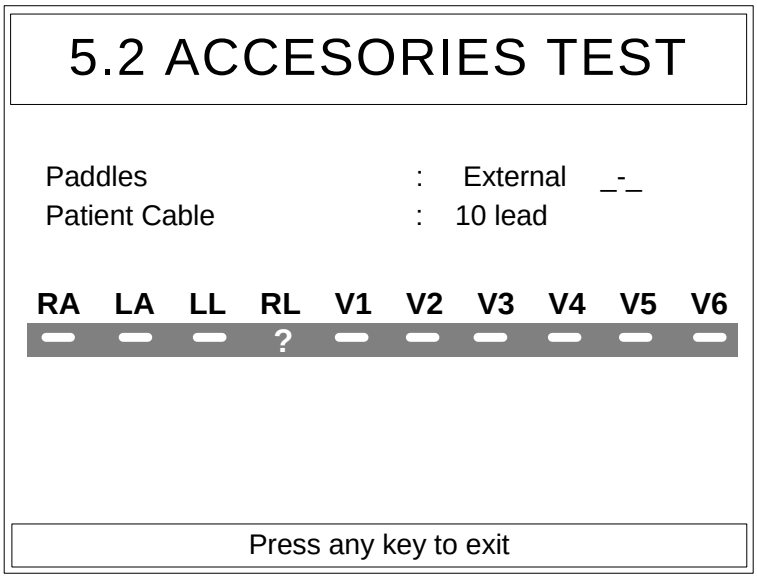


12.3 Accessories Test

This option allows the operation of the accessories connected to the equipment, understanding as such, the patient cables and the paddles, to be checked.

In the case of the paddles the type is shown and beside a symbol that indicates if the paddles are in short circuit (__) or in open circuit (_ - _).

When this option is accessed the following screen appears:



1- *PATIENT CABLE* – Indicates the type of patient cable that is connected the unit (3, 5 or 10 lead) in the moment of carrying out the test. In the case that there is no patient cable connected to the unit itself the word NONE will be shown.

2- *PADDLES* – Indicates the type of paddles that are connected to the unit at the moment of carrying out the test: External paddles (EXTERNAL), Internal paddles (INTERNAL) or Disposable paddles (DISPOSABLE). In the case that there is no paddle connected the word DISPOSABLE will also be shown.

By means of this Test the operation of the patient cable loose lead detection circuit can be checked. In the lower part of the screen a representation of the patient cable leads appears. If a cable of less than 10 leads is connected, under the name of the lead that does not exist the symbol "-" appears. If the lead is not connected under the indication appears the symbol "X" and if the lead is connected the symbol "O" appears.

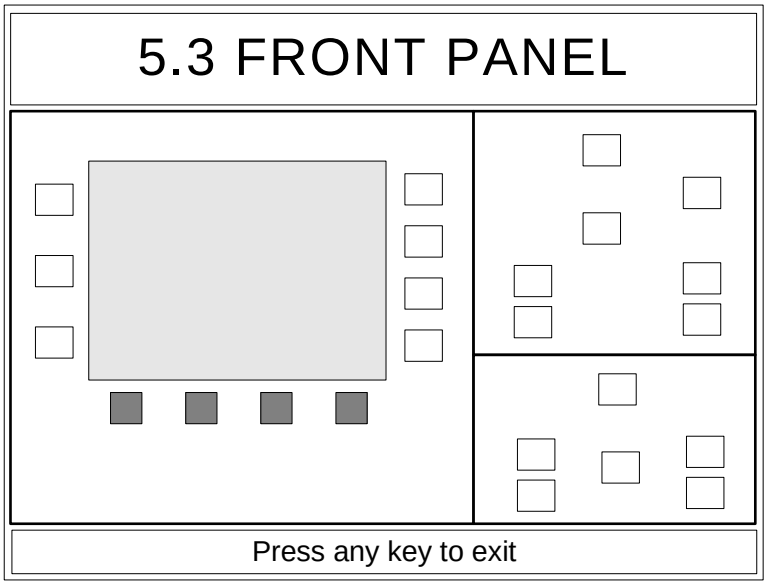
In the RL lead the symbol "?" always appears, since this is the one that is taken as reference. If this lead is not connected, in all the remaining leads the symbol "x" appears, since the connections cannot be checked.

NOTE: In case of working with 3 lead patient cable, only the cable type will be indicated, but it will not be possible to check the connection of the different leads, since with this type of cable indication of loose lead is not given.

12.4 Front Panel Test

This option allows the correct operating of all the keys and indicators of front panel to be checked. When this option is accessed, a screen appears with a graphical representation of the front panel that includes all the keys of the REANIBEX 700Series. The function keys located below the screen appear illuminated. The correct operation of the above-mentioned keys is checked on exiting this option, since it is necessary to touch one of the function keys to exit.

While in this option, the battery and malfunction indicators will blink a red colour, their correct operation being checked in this way.

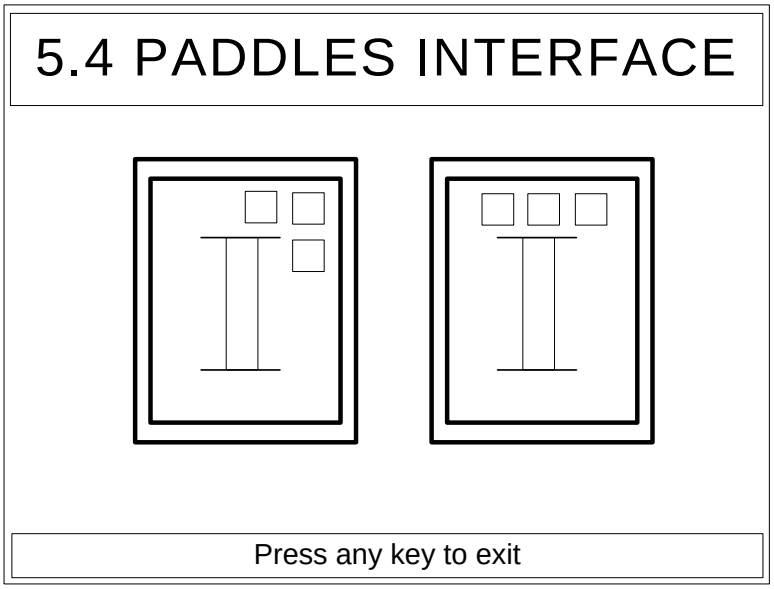


It is an interactive test. On pressing the different keys of the front panel of the unit, its graphical representation is illuminated on the screen and a beep is emitted. If the above-mentioned key has an associated luminous indicator, this is illuminated during the time that the key is pressed.

12.5 Paddles Interface Test

This test, like that of the previous section, is an interactive test that allows the operation of the interface with the reusable external paddles to be checked. On accessing this option, a graphical representation of the paddles with all its keys appears.

If this option is accessed without having reusable external paddles connected to the unit, the message " NOT CONNECTED " will appear. To be able to carry out the test, it is necessary to exit from the option, to connect the reusable external paddles to the unit and to re-enter.



On pressing the different paddles keys their position is illuminated on the screen.

13.Troubleshooting

The REANIBEX Series 700 carries out self-checks at start-up and during its operation in the different modes, in order to detect possible problems that may cause incorrect operation of the unit.

If an anomalous condition is detected during any of these self-checks, the equipment will act in two different ways, depending on the type of error detected:

- **SERVICE RECOMMENDED**– A fault that affects some part of the unit, not considered critical for its operation or for the operation of any of the accessories, is detected. Depending on the type of fault detected the unit will work in a some ways and not in others.

  When this type of malfunction is detected on switching on the unit:

  1. The LED service indicator placed in the front screen of the unit remains lit and steady.
  2. A message will appear on screen indicating the type of error detected. If it is an error that affects only one of the operating modes, whenever this mode is accessed a message will be given that indicates the error detected. Furthermore for those modules with this facility, an icon will appear in the upper part of the unit screen indicating the type of error detected.

- **OBLIGATORY SERVICE** – The error detected requires the immediate intervention of Authorized Technical Service personnel, and affects elements critical for the correct operation of the equipment. The unit will remain out of service.

  When this type of malfunction is detected on switching on the unit:

  1. The LED service indicator will blink until the malfunction is corrected.
  2. An on-screen message will appear indicating the type of error detected.

13.1 Error Codes

The following list shows the different error codes that the unit may display, together with an explanation of the system that they affect:

CODE	ERROR
GENERAL errors	
1	Error in the STARTUP of the device
10	Error in the device's external RAM
11	TEMPERATURE greater than MAXIMUM error
12	TEMPERATURE greater than MINIMUM error
13	HIGH SUPPLY VOLTAGE error
14	LOW SUPPLY VOLTAGE error
15	Error in the DUART
PATIENT SUBSYSTEM errors	
30	The PATIENT SUBSYSTEM does not respond
31	Corruption in the integrity of data error
32	Error in the Vref SUPPLY Electrodes
33	Error in the Vref SUPPLY Patient cable
35	Error in the IMPEDANCE MEASUREMENT CIRCUIT
36	Error in the calibration resistance of the IMPEDANCE MEASUREMENT CIRCUIT
37	Error in the ECG CIRCUIT
38	Error in the OPEN CIRCUIT DETECTION CIRCUIT
39	Error in ECG filter
HV BOARD (Charging Circuit) Errors	
40	Error in the HV BOARD CIRCUITS
41	OVERCURRENT in discharge error
42	Maximum time in discharge error
43	Error in the DISCHARGE: Little energy discharged

44	TOO FAST charging of the capacitor error
45	TOO SLOW charging of the capacitor error
46	CANNOT HOLD THE CHARGE error
47	Error in READING of the VOLTAGE of the main capacitor
HV BOARD (Discharge – Relays circuit) errors	
50	Error in the DISCHARGE CIRCUIT - Does not discharge
51	Error in the STG_1 Test RELAY connection
52	Error in the STG_2 Test RELAY connection
53	Error in the DISCHARGE RELAY connection
HV BOARD (Discharge – Semiconductors circuit) errors	
60	Error in BRANCH 1 - Open semiconductor
61	Error in BRANCH 2 - Open semiconductor
62	Error in the SCR 1 - Semiconductor in short circuit
63	Error in the SCR 2 - Semiconductor in short circuit
64	Error in the IGBT 3 - Semiconductor in short circuit
65	Error in the IGBT 33 - Semiconductor in short circuit
66	Error in the IGBT 4 - Semiconductor in short circuit
67	Error in the IGBT 44 - Semiconductor in short circuit
Errors in the PACEMAKER	
70	Error in the Pacemaker DC VOLTAGE
71	Error in the Pacemaker DAC converter
72	Error in the SENSE CIRCUIT of the pacemaker
73	Error in the SENSE CIRCUIT of the pacemaker (first sense)
74	Error in the pulse switch
75	Error in pulse protection
76	Error in current
Errors in PULSE OXIMETRY	
80	Error in the start-up
81	Error in communications

Errors in the PRINTER	
90	Recorder NOT READY
Errors in the COPROCESSOR	
100	Coprocessor not ready
101	Coprocessor without audio messages
102	Coprocessor does not understand the messages
103	Error in the 3.3 V voltage
104	Error in audio recording
105	Generic error
Errors in the RTC	
220	There is no communication with the RTC
221	Error in the format of RTC data
Error in the BATTERY	
240	No battery present
241	Low VOLTAGE in the BATTERY

13.2 Tests

In this section, the different test carried out by the equipment are described, and the error code which is shown on screen if the verification is not fullfilled

- **CPU TEST**

It is the basic test of the CPU. Durign this test, the following devices are tested:

- **RTC** - It performs a test of the format of the data readed in the real time clock (in fact, it checks the data). If data do not have the right format, it returns the **error 221**.
- **DUART -** It performs a reading of the DUART predefining register. If the reading is not according to the expected result, it returns the **error 15.**

- **Temperature sensor -** It performs a reading of the temperatura and checks that the temperature is within the established limits. If the temperature is greater than the upper limit it returns the **error 11**. If the temperature is below the minimum limit, it returns the **error 12.**

➢ **Power Supply Test**

The general supple of the unit is tested. If this value is above the established upper limit, it returns the **error 13**, and if i is below the minimum limit, it returns the **error 14**. Furthermore, on the test screen, the measured voltage value is shown.

➢ **Battery Test**

It is tested if the battery is connected or not. In the case that there is a battery connected, the readed voltage value is shown on the screen.

➢ **Patient Monitor Test**

The patien monitor is reseted, and the CPU waits until the ADuC communicates. If a timeout is produced, that is, the ADuC does not communicate within the established time, the **error 30** is returned**.**

If the ADuC answers, several data are requested and after that, the calibration of the circuits is performed connecting then to the calibration resistor (STG_CAL a 1).

If there have been any error the CPU goes on testing the rest of the patient monitor circuits:

1. **ADuC Overall Test** - The ECG is reseted setting the signal RST_BPF to 1. If the ECG value is no within a range the equipment returns the **error 32**, which indicates that the voltage in the base-line is not the half of 2.5V. If the value of the ECG from the patient cable is not within a range, the equipment returns the **error 33**, which indicates that the voltage in the base-line is not the half of 2.5V
2. **Impedance circuit Test** - It is connected to the calibration resistor and the ADuC performs the impedance circuit test. It is checked the impedance value in both the high and the low range.

   The high range is selected (signal ZP_GAIN to 1) and the impedance value is readed, if it is higher than 425 mV, the low range is selected (signal ZP_GAIN to 0) and it returns the **error 35** and finishes the test.

If in the high range the measurement has been good, the low rango is selected(signal ZP_GAIN to 0). The calibration value is readed and it is saved in the ADuC Flash memory and then, it is checked if there is deviatioon between the measure valuey and the stored value of previous calibrations. If the deviation is outside the established range, the equipment returns the **error 36** and finishes the test.

After that, the ADuC performs the ECG circuit test.

3. **ECG circuit Test.** The ECG buffer is reseted (signal RST_BPF to 0) in order to discharge the capacitor and the 50 mV ECG reference signal is selected.

   The ECG cannel is readed. If this value is outside the expected range, **error 37** is returned and the test is finished.

   The filter is re-establish (signal RST_HPF to 1), the ECG channel is readed and if it is outside the expected range **error 39** is returned and the test is finished.

   The ECG channel is readed, because the ECG signal should be lessening. If this does not happen, **error 39** is returned and the test is finished.

   Finally, the equipment tests that the base-line voltaje is the expected one. If this does not happen, **error 37** is returned and the test is finished

4. **OCD Test (open circuit detection circuit for patient cable leadwire) and DAC0 converter**

   The test signal for the test voltages of the OCD is putted off (signal TEST_LEAD_OFF to 0) and there is no patient cable connected is verified. If there is no patient cable the equipment goes on with the test. It is check is any of the leadwires seem to be disconnected, and if it is true **error 38** is returned and the equipment finished the test.

- **Coprocessor Test**

If the option is not included, the equipment advised the user and finishes the test. If the option is included, the SH2 U3 is reseted (negative pulse in COP_RST_NOT), and the microprocessor performs severals tests and return the result. The error codes that can return are the following:

- **100**: the coprocessor does not communicate.
- **101**: the coprocessor does not have recorded the audio messages
- **102**: the coprocessor does not undertand command codes, misundestanding between SW versions.
- **103**: error in the 3.3 V power supply. The voltage reading performed by the microprocessor is no within the limits.

- **104**: error in the audio recorder. There is an error in the communication with the compressor.

If there have been any error, the equipment returns the code, and if it no returns OK.

After this, the wellcome message is emitted to check the audio reproduction. It the wellcome message is no heared, check the following elements:

- The speaker must be connected.
- Check the reproduction path (U18, U68 y U15).
- Check that U7 is recorded

➢ **Defibrillator Test**

At the begining of the test, the 15V power supply is activated (PWRON_15 to 1), the defibrillator is connected to the test resistor (control signal STG_1 to 1) and it is assumed that the relay 2 is connected by default to the test resistor (STG_2 to 0). The defibrillator is also disconnected from the internal discharge protection resistor.

This test is made up by several verifications that perform consecutively. If there is an error in any of then, the equipment does not perform the following test. At the en of the defibrillator tests, regardless if all the test have been executed or not, all the semiconductors are oppened to discharge the main capacitor through the test resistor and the internal discharge protection resistor is connected. The 15V power supply is switched off 15V (PWRON_15 to 0).

At the end of this verification, an OK is shown on screen if there have no errors or the error code

1. **Presence Test** - Alarms are configured, so that it could be possible to distinguish is the 40 pin flat cable is connected or not. If there is no cable, the **error 40** is reported and the test is finished.
2. **Low voltage Test** 15V power supply is activated (PWRON_15 to 1), the main capacitor is disconnected from the discharge resistor (HV_STG0 to 1) and a charge at a low voltage is programmed (200 V in this case). During this process the following errors can occur:
   - **error 47**: charged voltage do not coincide with the programmed one
   - **error 44**: fast charge. The possible cause of this error is that the main capacitor is not connected.
   - **error 45**: slow charge. Possible causes of this error are:
     - Discharge resistor conection relay does not activate

- Fly-Back power supply does not work. Two possible causes:
  1. It is not possible to program the desired charge speed.
  2. It is not possible to set to ON the supply (check the relay and the fuse).

If there have been an error, the discharge resistor is connected to assure the protection and the test is finished. Otherwise, the capacitor charge is maintained for the following phase.

3. Discharge test through the internal discharge resistor:

It is asume that the relay 2 is connected to the test resistor (STG_2 to 0). The discharge resistor is connected (HV_STG0 to 0) for a short time and it is again disconnected (HV_STG0 to 1). It is tested that during that time, there has not been a lost in the voltage. On the contrary, the **error 53** is returned and the test is finished. As it was said before, this force the discharge of the main capacitor through the test resistor.

4. Discharge test through the test resistor:

Alarms are activated and the discharge through the first branch is forced (HV_SCR1, HV_IGBT3 y HV_IGBT33 to 1 // HV_SCR2, HV_IGBT4 y HV_IGBT44 to 0). The oscillator is switched on and it is tested is a discharged has been produced. Then, the discharge is forced through the second branch (HV_SCR1, HV_IGBT3 y HV_IGBT33 to 0 // HV_SCR2, HV_IGBT4 y HV_IGBT44 to 1) and it is tested if the discharged has been produced. The error codes that this test can generate are the following ones (if there has been any error the test is finished):

- **error 50**: Error in the two discharge branchs
- **error 60**: Branch 1 error.
- **error 61:** Branch 2 error.

Then, the Relay 1 is disconnected (STG_1 to 0) and it is tested that there has not been a lost in the voltage. On the contrary, the **error 51** is returned and the test is finished. In any case, the relay Relé 1 is again connected (STG_1 to 1).

Then, relay 2 is connected (STG_2 to 1) and it is tested that there has not been a lost in the voltage. On the contrary, the **error 52** is returned and the test is finished. In any case, the relay Relé 2 is again disconnected (STG_2 to 0).

5. **Overcurrent protection Test -** It is considered that the main capacitor is charged to a voltage not higher than 400 V. Alarms are reseted (positive pulse in the signal HV_REARM) and a shortcircuit is forced (HV_SCR1, HV_IGBT4 y HV_IGBT44 to 1). The pulse oscilator is switched on, and after 20 msec it is tested if the overcurrent alarm has produced. If there have not been any alarm the **error 41** is returned and the test is finished. In any case, the pulse oscilator is switched off and the alarms are reseted.

6. **High voltage Test -** This test is similar to the low voltage one, but a higher voltage (800V). The errors that can occur are the same as in the low voltage test.
   - **error 47**: the charge voltage does not fit in with the programmed one.
   - **error 44**: fast charge. The posible cause of this error is that the main capacitor is not connected.
   - **error 45**: slow charge**,** possible errors:
     - The relay that connects the discharge resistor is not activated.
     - The Fly-Back power supply does not work. There are two posible cause for this:
       1. It is not possible to program the required charging speed.
       2. It is not posible to switch on the power supply (check the relay and the fuse).

   If there has been any error, the discharged resistor is connected for protection reasons, and the test is finished. On the contrary if the test has been correct, the main capacitor is left charged for the next step.

7. **Discharge circuit Test** - It is assumed that the main capacitor is charged to a voltage of 800 V. The Test resistor is connected (STG_1 y STG_2 to 0) and several elements are tested:

- **SCR-s Tests:**

  All the semiconductors are opened, and another high voltage test is performed to charge the main capacitor to 800 V. If there has been any error, it is started with the SCR-s Test

  First, the SCR_1 is tested. Only the iGBT-s are connected (HV_IGBT3 and HV_IGBT33 to 1) and the SCR_1 is remained open. If it is discharged the **error 62** is returned and the test is finished. If there has been any error, both the iGBT-s (HV_IGBT3 and HV_IGBT33 to 1) and the SCR (HV_SCR1 to 1) are connected and it is tested is there is a discharge. If there is no discharge, it is returned the **error 62** and the equipment finishes the test.

Next, the SCR_2 is tested. Only the iGBT-s are connected (HV_IGBT4 and HV_IGBT44 to 1) and the SCR_2 is kept open. If it is discharged the **error 63** is returned and the test is finished. If there has been any error, both the iGBT-s (HV_IGBT4 and HV_IGBT44 to 1) and the SCR (HV_SCR2 to 1) are connected and it is tested is there is a discharge. If there is no discharge, the **error 63** is returned and the test is finished.

- **iGBT-s Test:**

The first branch is closed (HV_IGBT3, HV_IGBT33 and HV_SCR1 to 1) and the second one is opened (HV_IGBT4, HV_IGBT44 and HV_SCR2 to 0). The oscillator is switched on, and the discharge is being carring out is checked. Then the iGBT3 is opened (HV_IGBT3 to 0) and that there is no discharge is checked. If there has been any error, the **error 64** is returned and the test is finished. The same process is repeated for the iGBT33. If there is an error, the **error 65** is performed and the test is finished.

All the semiconductors are opened and the branch is changed (HV_IGBT3, HV_IGBT33 and HV_SCR1 to 0 // HV_IGBT4, HV_IGBT44 and HV_SCR2 to 0). The iGBT4 and the iGBT44 are tested. The corresponding errors are **error 66** and **error 67.**

- **Time protection Test.**

Alarms are restarted (positive pulse in HV_REARM) , a virtual discharge of 50 msecs is performed (HV_SHOCK to 1 and the oscillator is switched on) and the time alarm is checked. If the alarm does not produce between 20 and 30 milliseconds, the **error 42** is returned because it should trip after 24 msec. Alarms are restarted, the discharge resistor is disconnected and the test result is returned.

Finally, the main capacitor is discharged, all the semiconductors are opened, the test resistor is disconnected, the discharge resistor is connected and the15V source is switched off.

- **Pacemaker Test**

If this option is not included the equipment advises the user and finishes the test.

If the option is included, the pacemaker is connected to the internal resistor, and the relays control signal as configured as follow: (STG_1 to 0, STG_2 to 1, STG_3 to 0). The Flyback source is activated using the control signals (PMK_ION and PMK_FLYBACK to 1).

The following tests are performed:

1. **125V source Test** - SENSE_DC_A channel is selected in the multiplexer U8 and the collected value in the CPU is readed through an AD converter (AN4). If this value is no within a range (around 125V), the **error 70** is returned and the test is finished.
2. **DAC(U3) Test -** A series of values are programmed in the converter DAC(U3), the VDAC channel in the multiplexer U8 is selected and the collected value in the CPU is readed through an AD converter (AN4). If this value is not within a limits (90% of the programmed value), the **error 71** is returned and the test is finished.
3. **Pulse current Test -** The pulses are programmed with an amplitude from 20 mA to 100 mA. For each current pulse the following verification is performed:
    - The corresponding current is programmed
    - It is verified that there is no current to the patient through the upper chanel of SENSE because the pulse is not active. If it is not true, the **error 74** is reported and the test is finished.
    - The pulse is activated and the two SENSE signal are readed. If there is deviation outside the range between the two measurements the **error 72** is returned and the test is finished. If the two measurements are equal, one of then is compared with the programmed value. If there is a deviation outside the range the CPU reports the **error 73** and finishes the test.
4. **Pulse protection Test** - A low current is programmed (20mA) and the pulse is activated (PMK_PULSE to 1), the equipment waits for 80 ms and read the current in high SENSE. If there is more than 5 mA the protection has fault, because there should have tigger at 65 ms. The pulse is deactivated (PMK_PULSE to 0) and a null current is programmed. If there is an error, the **error 75** is returned and the test is finished.

When the pacemaker test is finished, the supply is disconnected (PMK_ION and PMK_FLYBACK to 0) and the pacemaker internal resistor is disconnected (STG_2 to 0). To finish the test result is returned: OK if all the tests have fullfilled or the code of the first error.

- **Pulsioximeter Test**

In the case that the option is not included, the equipmente avised the user.

If the option is included, the equipment resets the pulsioximeter through the DUART and waits the pulsioximeter inicial message. If the message is the correct one, the equipment shows the type of pulsioximeter and if not, it returns the **error 80**.

- **Recorder Test**

In the case that there is no recorder, the equipmente avised the user.

If the option is included, the equipment checks the recorded status reading one of its pins. If this pin is no correct, it returns the **error 90** and finishes the test.

After the initial verification, it is tested if the recorder door is open or if it is out of paper and the equipment finishes the test showing the result of the test.

13.3 Actions to be Performed

When the REANIBEX 700 Series detects some anomaly on performing the different self-checks (at start-up, while operating, at start up of the module and during manual tests), this fact will be reflected by means of the malfunction indicator located in the equipment screen (blinking or it will remain steady depending on the type of error detected) and by means of on-screen messages. This indication will be given whenever the equipment is switched on until the malfunction is resolved. Furthermore if the error detected is critical and prevents initiation of procedure with the unit, at start-up a screen will appear along with an error code.

In the case that the error affects only some modules of the unit, whenever it is attempted to access this module an error detected indication will be given by means of an on-screen message, and access to this operating mode will be prevented.

If the unit shows an error screen with a code, it will be possible to start it only in "**CONFIGURATION MODE**", and its start-up to provide treatment to a patient will never be allowed. The purpose of allowing start-up of the unit only in this mode of operation is to allow the user to carry out different Manual Tests to determine in which elements or modules the error has been detected.

To access the Configuration Mode, it is necessary to switch the unit on keeping pressed the MENU key  located in the front panel, until the configuration screen appears.

As soon as the configuration mode main screen appears, the option "**5. TESTS**", should be accessed, and within this "**5.1 TEST HARDWARE**", since this is the test entrustd with checking the main elements of the unit.

If after carrying out the test, the error continues, the equipment needs to be repaired. By means of the error code or codes indicated during the carrying out of the Hardware Test the elements or equipment modules whose operation is considered to be faulty can be determined.

13.4 Problems Summary Table

PROBLEM OBSERVED		ACTIONS TO BE PERFORMED
PHYSICAL EXAMINATION	Broken or dirty unit casing	Replace the unit casing or clean it following the cleaning recommendations described in this manual
	Broken or missing recorder or Compact Flash covers	Replace the covers that are damaged making sure that they close correctly
	Broken external pads securing.	Replace external pads securing system
	Broken or missing hardware	Locate and replace the broken or missing elements
	Damaged or detatched labels	Replace the labels
	Multifunction connector (MFC), patient cable connector or pulse oximetry connector dirty or broken	Replace or clean the connector that is dirty or broken
	Mains supply connector or external battery connector dirty or broken	Replace or clean the connector that is dirty or broken
	Broken, scratched or dirty unit screen	Replace the unit screen, or clean it with a soft cloth.

STARTUP	The unit does not start	If working from battery, use a fully charged battery or connect the unit to the mains or to an external battery Check the connections to the HV Board of the internal battery, the mains supply and the external battery Check the battery terminals and the polarity of the battery connectors, of the external mains and of the external battery Check the internal fuse and confirm that it has not blown Check that the start-up key works correctly, and check the connection between the keyboard and the Display board Check the connections between the HV Board and the CPU board and between the CPU board and the Display board Check or replace the CPU board Check or replace the HV board Check or replace the Display board
KEYBOARD DISPLAY KEYS	The equipment does not respond to pressing of the keys located in the display area of the keyboard or the LEDs associated with this area do illuminate	Make sure that the equipment has supply (internal battery, mains connection or external battery) Check the display keyboard by means of the Interface Test Check the connections between the keyboard and the Display board Check the connections between the Display board and the CPU board. Check or replace the CPU board Check or replace the Display board

KEYBOARD FUNCTION KEYS	The equipment does not respond to pressing of the keys located in the functions area of the keyboard, or the LEDs associated with this area do not illuminate	Make sure that the equipment has supply (internal battery, mains connection or external battery) Check the functions keyboard by means of the Interface Test Check the connections between the keyboard and the printer support board Check the connections between the printer support board and the CPU board Check or replace the CPU board Check or replace the printer support board
BATTERY AND MAINS INDICATION	The supply indicators do not illuminate	Check the connections of the internal battery, the mains supply and the external battery, to the HV board Check the functions keyboard and the indicators by means of the User Interface Test Check the connections between the keyboard and the printer support board Check the connections between the HV board and the CPU board. Check the connections between the printer support board and the CPU board Check or replace the CPU board Check or replace the HV board Check or replace the printer support board
DATE And TIME	Date and hour shown are incorrect It is not possible to set the date and time	Enter in Configuration Mode and access the 'Date/time' menu to set the date correct and time. Replace the CPU board battery Check the instructions and try again to set the date and time Replace the CPU board battery Check the keyboard and the connections from it to the CPU card. Check or replace the CPU board

PATIENT IMPEDANCE	Measurement of the patient impedance has not been correctly carried out	Check the instructions and carry out the Hardware test again in order to calibrate the impedance meter Check the continuity of the patient electrodes connection cable Check the patient electrodes connector to see if it is damaged and/or broken Check the connection of the electrodes connector to the Power Board (APEX and EXT connectors) Check or replace the CPU board
MONITOR	The signal acquired by means of the disposable electrodes or the paddles is of bad quality	Check and if necessary replace the paddles or the disposable electrodes cable Check and if necessary replace the multifunction connector (MFC) Check the connection of the multifunction connector to the CPU board Check or replace the CPU board
	The signal acquired using the patient cable is of bad quality	Check and if necessary replace the patient cable Check and if necessary replace the patient cable connector Check the connection of the patient cable connector to the CPU board Check or replace the CPU board
	The % SpO2 value is not monitored	Check or replace the pulse oximetry sensor and/or the spiral cable Check and replace the patient cable connector if necessary Check the connection between the connector and the SpO2 board Check the connection between the SpO2 board and the CPU board Check or replace the SpO2 board Check or replace the CPU board

	This icon appears on screen 	Make sure that all the patient cable leads are correctly positioned Check and if necessary replace the patient cable Check and if necessary replace the patient cable connector Check the connection of the patient cable connector to the CPU board Check or replace the CPU board
	This icon appears on screen 	Check the connection between the connector and the SpO2 board Check the connection between the SpO2 board and the CPU board Check or replace the SpO2 board Check or replace the CPU board
	This icon appears on screen 	Check or replace the pulse oximetry sensor and/or the spiral cable Check and replace the pulse oximetry connector if necessary Check the connection between the connector and the SpO2 board
RHYTHMS DETECTION SYSTEM	Inappropriate or unintelligible on-screen messages	Enter in the 'Configuration Menu' and check the screen contrast Check the connections between the screen and the CPU board. Check the connections between the screen and the display board Check or replace the screen Check or replace the display board Check or replace the CPU board
	Inappropriate or unintelligible audible messages	Check the connection between the loudspeaker and the CPU board Check or replace the loudspeaker Check or replace the CPU board

	Inappropriate response to NON-DEFIBRILLABLE rhythms.	Try to carry out the Hardware Test again and check its result Check that the rhythms simulator provides a non-defibrillable rhythm, checking the signal shown on-screen Check or replace the CPU board Contact OSATU for technical assistance
	Inappropriate response to DEFIBRILLABLE rhythms.	Try to carry out the test again and check its result Check that the rhythms simulator provides a defibrillable rhythm, checking the signal shown on-screen Check or replace the CPU board Contact OSATU for technical assistance
DEFIBRILLATION PROCESS	It does not charge the capacitor	Use a fully charged battery or connect the unit to an external power supply Check the connections between the energy storage capacitor and the HV board Check the connections between the HV board and the CPU board. Check and if necessary replace the energy storage capacitor. Check or replace the HV board
	Energy discharge does not take place	Check the instructions and carry out the operation again Check the connections between the energy storage capacitor and the internal discharge relay PCB Check the connections between the internal discharge PCB relay board and the Power Board Check or replace the Power board
	The energy supplied is outside of the tolerance ranges	Check or if necessary replace the energy storage capacitor. Check or replace the CPU board Check or replace the HV board

	The capacitor charge time is greater than 10 sec.	Use a fully charged battery or connect the unit to an external power supply Check or if necessary replace the energy storage capacitor Check or replace the HV board Check or replace the CPU board
PACEMAKERS	Stimulation with the pacemakers is not emitted	Check the connections between the pacemakers board and the HV board Check the connections between the pacemaker board and the CPU board. Check or replace the CPU board Check or replace the pacemakers board
RECORDER	This icon appears on screen 	Make sure that the recorder has paper and that the door is closed Check the connections between the recorder and the CPU board Check or replace the recorder Check or replace the CPU board
COMPACT FLASH CARD	This icon appears on screen 	Make sure that the card inserted in the unit is the correct one Check the Compact Flash card connector Check or replace the CPU board

Blank page

A.1 Manufacturer's guide and declaration of Electromagnetic Compatibility

The REANIBEX Serie 700 has been designed and tested to meet the requirements of the international standards for conducted and radiated emissions. The following tables provide detailed information on the Guide and Declaration for Electromagnetic Compatibility.

The lists of cables, transducers and other accessories that have been approved by the OSATU and conform to their requirements on immunity and emissions in Standard IEC 60601-1-2 are listed in Annex "A12. Accessories".

WARNING: The use of accessories, transducers or cables which are different from those specified in this manual could result in an increase in emissions or reduce the immunity of the REANIBEX Serie 700.

El REANIBEX Serie 700 is designed to be used in the electromagnetic environments specified in the following tables. The user of the device must make sure that the device is utilized in these environments.

The following tables indicate the minimum separation distances that are recommended between the REANIBEX Serie 700 and portable and mobile communication devices.

ELECTROMAGNETIC EMISSIONS (EMC)		
The REANIBEX Serie 700 is designed for use in electromagnetic environments as specified below. The client or user of the REANIBEX Serie 700 must ensure that is used in this environment.		
Emission Test	**Compliance**	**Electromagnetic environment- Guide**
RF Emissions CISPR11	Group 1	The REANIBEX SERIE 700 uses RF energy only for its internal operation. Therefore, its emissions are very low and it is not probable that they would cause interference in nearby electronic equipment.
RF Emissions CISPR11	Group B	
Harmonic Emission IEC 61000 3-2	Class B	

Voltage fluctuations/Flicker Emission IEC 610003-3	Conforms	
Electrical Medical Equipment requires special precautions with respect to EMC and needs to be installed and put into service in accordance with the EMC information provided in this document.		

ELECTROMAGNETIC IMMUNITY

The REANIBEX Serie 700 is designed for use in electromagnetic environments as specified below. The client or user of the REANIBEX Serie 700 must ensure that is used in this environment.

Immunity Test	**Test Level IEC 60601**	**Level of Compliance**	**Electromagnetic environment-Guide**
Electrostatic Discharge (ESD) IEC 61000 -4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	The flooring should be made of wood, concrete or ceramic. If the flooring is covered with synthetic material, the relative humidity should be at least 30%.
Fast/burst electric transients IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	Conforms Not applicable	
Impulses (Surges) IEC 61000-4-5	± 1 kV differential mode +/- 2 kV common mode	Conforms Conforms	
Voltage drops, short interruptions and changes in the voltage in the input power supply lines IEC 61000-4-11	<5% Ut (>95% drop in Ut) for 0.5 cycles 40% Ut (60% drop in Ut) for 5 cycles 70% Ut (30% drop in Ut) for 25 cycles >5% Ut (<95% drop in Ut) per 5 seconds	Conforms Conforms Conforms Conforms	

Magnetic field at power line frequency (50/60Hz) IEC 61000-4-8	3 V/m	Conforms	The magnetic fields should be at levels characteristic of a typical location in a commercial environment or a busy hospital environment
NOTE: U_t is the AC voltage before the test level application			

ELECTROMAGNETIC IMMUNITY

The REANIBEX Serie 700 is designed for use in electromagnetic environments such as those specified below. The client or user of the REANIBEX Serie 700 must ensure that is used in this environment.

Immunity Test	**Test Level IEC 60601**	**Level of compliance**	**Electromagnetic environment-Guide**
			RF mobile and portable communications devices must not be used next to any component of the REANIBEX SERIE 700, including the cables at recommended separation distances less than those calculated from the equation applicable to the transmitter frequency.
			Recommended separation distances
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz at 80 MHz outside the ISM[a] bands	3 V	
	10 Vrms 150 kHz at 80 MHz in the ISM[a] bands	10 V	
Radiated RF IEC 61000-4-3	10 V/m 80 MHz at 2.5 GHz	20 V/m	d =0.6 √ P of 80MHz at 800MHz d =1.15 √P of 800MHz at 2.5GHz
			P is the maximum output power

			magnitude of the transmitter in Watts (W) according to the manufacturer of the transmitter, and *d* is the recommended separation distance in meters (m)[b] The field intensity of fixed RF transmitters, as determined by measurement of the electromagnetic disturbance in the area, must be less than the compliance level in each frequency range [d] Interference can occur within the vicinity of devices marked with the following symbol: 

NOTE 1: At 80 MHz, the highest frequency range is applied.

NOTE 2: These utilization guidelines cannot be applied to every situation. Electromagnetic propagation is affected by absorption and reflection in structures, objects and people.

[a] The ISM bands (industrial, scientific and medical) between 150 kHz and 80 MHz are from 6.75 MHz to 6.795 MHz; from 13.553 MHz to 13.567 MHz; from 26.975 MHz to 27.283 MHz; and from 40.66 MHz to 40.70 MHz.

[b] The degree of compliance in the ISM frequency bands between 150 KHz and 80 MHz and in the range of frequencies from 80 MHz to 2.5 GHz, is designed to reduce the probability that mobile/portable communication equipment can cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 is used in the calculation of the separation distances recommended in these frequency ranges.

[c] The field intensity of fixed transmitters, such as base stations for radio (cellular and wireless), telephones, land mobile radios and amateur radios, AM and FM radio broadcasts, TV broadcasts, cannot be theoretically predicted with accuracy. To evaluate the electromagnetic environment due to RF fixed transmitters, an on-site measurement must be considered. If the field intensity measured in the location using REANIBEX SERIE 700 exceeds the applicable RF level of compliance, the REANIBEX SERIE 700 must be examined to verify normal operation. If abnormal operation is observed, additional measures will need to be taken such as reorientation or repositioning of the REANIBEX SERIE 700.

[d] In regards to the range of frequencies from 150 kHz to 80 MHz, the field intensities must be less than (V_1) V/m

Recommended separation distances between RF mobile and portable communication devices and the REANIBEX Serie 700

The REANIBEX Serie 700 is designed for use in environments in which radiated RF interference is controlled. The client or the user of the REANIBEX Serie 700 can help to prevent electromagnetic interference by maintaining a minimal distance between RF mobile and portable communications equipment (transmitters) and the REANIBEX Serie 700 as is recommended below, in accordance with the maximum outlet power of the communication device.

	Separation distances according to the transmitter frequency (m)			
Maximum output power of the transmitter W	150 KHz to 80 MHz outside of the ISM bands d =1.16 √P	150 KHz to 80 MHz within the ISM bands d =1.2 √P	80 MHz to 800 MHz d =0.6 √P	800 MHz to 2.5 GHz d=1.15 √P
0.01	0.1	0.1	0.06	0.11
0.1	0.4	0.4	0.19	0.36
1	1.2	1.2	0.60	1.15
10	3.7	3.8	1.90	3.6
100	11.6	12	6.00	11.50

For transmitters with maximum output power not specified above, the recommended separation distance d in meters (m) can be determined using the equation applicable to the transmitter frequency, where P is the maximum output power in watts (W) according to the manufacturer of the transmitter

NOTE 1: At 80 MHz and 800 MHz, the separation distance is applied for the highest frequency

NOTE 2: The ISM bands (industrial, scientific and medical) between 150 kHz and 80 MHz are from 6.75 MHz to 6.795 MHz; from 13.553 MHz to 13.567 MHz; from 26.975 MHz to 27.283 MHz; and from 40.66 MHz to 40.70 MHz.

NOTE 3: An additional factor of 10/3 is used in the calculation of separation distances recommended in the ISM frequency bands between 150 kHz and 80 MHz and in the range of frequencies of 80 MHz to 2.5 GHz, to reduce the probability that the mobile/portable communication device might cause interference, if it is inadvertently taken to patient areas.

NOTE 4: These utilization guidelines cannot be applied to every situation. Electromagnetic propagation is affected by absorption and reflection in structures, objects and people.

Blank page

A.2 Essential functions

The essential functions of the unit to be considered are:

- Maintenance of the unit configuration, including: the MAINS filter chosen (50/60Hz), sensitivity of on-screen signals, the (0.5-35 Hz or 0.5-150Hz) filter, values of the alarms, operating parameters in manual and automatic defibrillator mode,
- To control the functions of the unit using the keyboard
- Detection and indication of the following conditions: patient ECG monitor cable loose, defibrillation electrodes loose, batteries condition, type of supply, error conditions (pacemakers, pulse oximetry, recorder, coprocessor, charge/discharge circuit etc).
- On-screen viewing: of the SpO2 signal and % value, CF value, ECG signals, pacemaker parameters: frequency, amplitude and operating mode
- Presentation in printer: ECG Signals and incidences, CF and % SpO2 value every 30 cm of paper, pacemakers pulse
- Controlled energy charging, at different levels
- Controlled energy discharging
- Synchronization of energy discharge with the signal
- Automatic defibrillation (*)
- Operation of the pacemaker in the modes: fixed and on-demand
- Measurement of patient impedance
- Identification of the type of electrodes for monitoring and for defibrillation
- Supply to the unit: maintenance of the functionality in each one of its options (230Vac, internal battery and external battery)
- Internal battery during operation of the unit, when the unit is supplied: from the 230Vac mains or from an external battery.

(*) This function will only be considered in the case that the Reanibex 700 Series has this option.

Blank page

A.3 Procedures for Changing Components

A series of instructions that permit disassembling, manipulating and safely reassembling, those elements that are determined to be replaceable in the REANIBEX 700 Series.

When disconnecting cables, label these cables and the connections in a way that facilitates later assembly. For additional information, consult the "Connections Diagram".

Before handling the components of the equipment, make sure that the energy storage element is discharged.

DANGER OF SHOCK: Maintenance of this unit must be carried out by properly qualified personnel. Potentially mortal electrical discharges can occur at any time in his unit.

DANGER OF SHOCK: High voltage at the energy storage capacitor.

Some electronic components can become damaged by static electricity discharges. These static discharges habitually occur when the operator is wearing synthetic clothes. To prevent static shocks keep in mind the following recommendations:

- Always carry out repairs or maintenance on a surface that dissipates static electricity, connected to earth.
- Always use a conductive wristband connected to the dissipative surface and to earth, except when the high voltage capacitor has energy stored; in this case first discharge this energy.

  DANGER OF SHOCK: Remove the wristband when the high voltage capacitor has energy stored; in this case first discharge this energy.

- Transport and store the PCBs in antistatic presses or in conductive bags. Label the packaging that contains PCBs ***"Sensitive to static electricity"***

- Keep the working area free from static electricity. For this purpose connect all electrical equipment to earth using a 3 pin plug.

Before opening the unit, disconnect all the cables connected to it (patient cable, of SpO2 sensor cable, paddles or disposable electrodes). When opening and closing the unit keep in mind the assembly diagrams described in this manual.

Replace parts designated as replaceable only with original replacement parts.

Once the equipment has been reassembled, enter Configuration mode and perform a Hardware Test in order to check the correct operation of the equipment. Also carry out a series of discharges at different energy levels, checking the energy discharged by means of a discharge checker or QED.

A.4 Assembly Diagrams

Blank page

OSATU S.Coop., will provide on request assembly diagrams, circuit diagrams, descriptions and any information that will help to appropriately qualified technical personnel to repair those parts of the unit that are designated by the manufacturer as repairable.