SCHILLER

MEDICAL S.A.

FRED MULTIPULSE BIOWAVE

(First Responder External Defibrillator Biphasic)

Notice technique

Version Juillet 2001

THE ART OF DIAGNOSTICS

Part No. 0-48-0001

Service Manual
Revision History

Version 1: July 2001

WARNING

This manual shall be considered to form an integral part of the described device.

This service manual is intended for qualified personnel. It describes the operating, maintenance and troubleshooting of MULTIPULSE BIOWAVE FRED devices.

Compliance with its contents is a prerequisite for correct device performance and the safety of the patient and the operator.

The manufacturer shall only be liable for the safety, reliability and performance of the device if:

- **all assembly, extensions, adjustments, modifications and repairs have been performed by the manufacturer or by persons authorised by the manufacturer.**
- **the electrical system of the premises of use is in accordance with applicable requirements.**
- **the device is used in accordance with the instructions for use.**
- **only original Schiller spare parts are used.**

This manual describes the device at the time of printing.

The provision of this manual shall not in any event constitute permission or approval to modify or repair the device.

The manufacturer agrees to supply all the spare parts for a ten-year period.

The use of the MULTIPULSE BIOWAVE FRED device shall comply with the description provided in the Operating Manual. The device shall not be put to uses other than as described in the manual, which may be hazardous.

SAFETY INFORMATION

- **The device bears the following marking:**

  CE-0459

  in accordance with the requirements of Council directive 93/42/EEC relating to medical devices, based on the essential requirements of Annex I of the directive.

- **The device fully meets the electromagnetic compatibility requirements of standard IEC 60601-1-2/EN 60601-2, "Electromagnetic compatibility of Medical Electrical Equipment".**

- **The device has undergone interference elimination in accordance with the requirements of standard EN 50011, class B.**

- **In order to ensure optimum patient safety, electromagnetic compatibility, measurement precision and device operation, users are advised to use only original Schiller spare parts. Users shall be solely liable for the use of accessories other than original accessories. The manufacturer shall not be liable for any damage due to the use of incompatible accessories or consumable supplies.**

- **The manufacturer shall only be liable for safety, reliability and device performance if:**

  - assembly, configuration, modifications, extensions or repairs have been made by Schiller personnel or personnel that have been duly authorised by Schiller.
  - the device is used in accordance with the instructions for use.

- **Users shall be entirely liable for any use of the device that does not comply with the procedures described in the Operating Manual.**

- **This manual describes the device and the technical safety standards applicable at the time of printing. All rights reserved for the circuits, processes, names, software and devices referred to in this service manual.**

- **The quality assurance system applicable in the manufacturer's facility meets the requirements of international standards EN ISO 9001 and EN 46001.**

- **No part of this document may be reproduced without the written permission of Schiller.**

Safety symbols used on the device

Danger – High Voltage.

Conventions used in the manual

Danger:	**Warns the user of an imminent hazard. If the warning is not heeded, the user (and/or people and property around the user) could be exposed to death or serious injury.**

Caution:	**Warning describing conditions or actions that could lead to device or software malfunctioning.**

Note:	**Remark or note providing useful information to enable the user to get the most from the equipment.** **Additional information or explanation about the previous paragraphs.**

Manufacturer:

SCHILLER
MEDICAL SA
19, Avenue de la Gare
F- 67 162 Wissembourg

Tel. : **33 / (0) 3.88.63.36.00
Fax : **33 / (0) 3.88.94.12.82

PRECAUTIONS REQUIRED WHILE TESTING THE DEVICE

While testing the MULTIPULSE BIOWAVE FRED device, only fixed resistors with high voltage and power ratings that are well insulated from the frame and the earth may be used to simulate the patient. Never use incorrectly insulated systems, systems with loose contacts or systems with components such as sparkers or flash tubes, as they could destroy the device beyond repair.

CONTENTS

1. DESCRIPTION OF THE MULTIPULSE BIOWAVE FRED DEVICE

This section provides a general description of the device, along with the specifications of the various functions and an overview of the optional features and accessories.

1.1. OVERVIEW

The **MULTIPULSE BIOWAVE FRED®** device is either a biphasic automated external defibrillator (AED) intended for use by first-aid personnel or a biphasic defibrillator that may be used in the manual mode (optional) by medical personnel.

The basic version of **MULTIPULSE BIOWAVE FRED®** includes the following:

- a monitor showing the various messages in the semiautomatic mode,
- an ECG input through adhesive defibrillation electrodes,
- an automatic VF/VT recognition function,
- a voice prompt function,
- a biphasic waveform defibrillation function,
- a battery slot designed for either a cadmium-nickel battery or a lithium cell,
- a charging connector for a cadmium-nickel battery,
- a connector for the PCMCIA memory card.

As an option, **MULTIPULSE BIOWAVE FRED®** may be fitted with the following:

- a function to display the ECG signal on the monitor,
- a three-lead ECG acquisition function through the patient cable,
- a twelve-lead ECG acquisition function through the patient cable,
- an SpO2 function,
- manual operating mode,
- a memory for saving the voices of carers,
- a function for the telephone transmission of the data saved on the PCMCIA card.

The following data are always displayed on the LCD screen:
- the time elapsed since the device was switched on,
- the number of shocks delivered since the device was switched on,
- the messages of the AHA/ERC protocol for AED mode operation.

The following data may be displayed on the LCD screen:
- the ECG signal, either from the adhesive defibrillation electrodes or from the patient cable,
- the heart rate with the heart rate unit,
- a systolic indicator,
- a battery symbol when the battery charge is low,
- a symbol indicating the recording of data on the memory card,
- the synchronising mode (only in the optional manual defibrillator mode, in the presence of a QRS signal),
- system alarm messages,
- defibrillator data: selected energy value, capacitor charging, defibrillator ready, safety discharge (with optional manual defibrillator mode),
- the pulse curve and the blood oxygen saturation rate (optional SpO2 feature).

1. DESCRIPTION OF THE MULTIPULSE BIOWAVE FRED DEVICE

With **MULTIPULSE BIOWAVE FRED**®, defibrillation is performed easily and safely (all the stages of defibrillation are displayed on the screen) in the semiautomatic mode or in the manual mode (optional).

- AED mode: the AED or semiautomatic mode can be set up in the factory on the basis of the protocol of the American Heart Association (AHA) or that of the European Resuscitation Council (ERC).
The **MULTIPULSE BIOWAVE FRED**® device offers two energy sequences in the AED mode:

- standard sequence: when ventricular fibrillation or ventricular tachycardia above 180 b/min is detected, an automatic charge of 130 J is started up for shocks 1 and 2, followed by 180 J for any subsequent shocks that may be needed,
- upon a request from the customer, the device may be factory-set with the following sequence: when ventricular fibrillation or ventricular tachycardia above 180 b/min is detected, an automatic charge of 90 J is started up for shock 1, followed by 130 J for shock 2 and 180 J for any subsequent shocks that may be needed.

- Manual mode: the energy value is selected through the manual defibrillator keyboard. The energy values available in the manual mode are as follows: 1 J, 2 J, 4 J, 6 J, 8 J, 15 J, 30 J, 50 J, 70 J, 90 J, 110 J, 130 J, 150 J and 180 J. In the manual mode, the selected energy value and the stored energy during the Defibrillator Ready phase are selected on the screen in order to detect any malfunctioning or operator error.
Also, a safety system automatically discharges the capacitor within the device if the energy stored is not used.

The triggering of the defibrillation pulse by the Shock key may be unsynchronised (semiautomatic mode with ventricular tachycardia or ventricular fibrillation) or synchronised (atrial fibrillation and flutters, supraventricular tachycardia in the manual mode).

1. DESCRIPTION OF THE MULTIPULSE BIOWAVE FRED DEVICE

1.2. SPECIFICATIONS

POWER SUPPLY

Battery power supply

Battery	:	Cadmium-nickel: 12 V – 2.4 Ah
Cell life	:	2.5 hours in the ECG monitoring mode or 110 defibrillation shocks at 180 J
Recharge	:	· DEFIGARD 2002 C2 · with a **FRED** vehicle charger connected to the battery charge connector · by FRED mains adapter
Charging time	:	· 1 hour with DEFIGARD 2002 C2 · 80% of the capacity after 20 hours through the battery charge connector · 100% of the capacity after 27 hours
Recycling frequency	:	· recommended after every 15 discharge cycles · at least once a month with the recycling schedule label affixed on the battery

Lithium cell power supply

Cell	:	Lithium: 18 V – 4.75 Ah
Cell life	:	5 hours in the ECG monitoring mode or 450 defibrillation shocks at 180 J (at 20°C)
Life after one year of installation in FRED with a daily operating test, without using the device	:	2 hours in the ECG monitoring mode or 150 defibrillation shocks at 180 J (at 20°C)
Life after five years of storage (at +10 to + 20°C) in the original packaging	:	4.5 hours in the ECG monitoring mode or 400 defibrillation shocks at 180 J (at 20°C)
Recharge	:	the lithium cell is not rechargeable

1. DESCRIPTION OF THE MULTIPULSE BIOWAVE FRED DEVICE

MONITOR PART

ECG signal

Inputs	:	· insulated – type CF · acquisition through a three-lead patient cable, four-lead patient cable, ten-lead patient cable or through adhesive defibrillation electrodes · leads I, II, III or ECG through the adhesive defibrillation electrodes · protection from defibrillation and pacing · impedance: > 2.5 MΩ at 10 Hz · common mode reject rate > 100 dB · noise at the input < 35 µV · patient lead current < 0.1µA · electrode impedance monitoring
Input voltage	:	· dynamics: ± 5 mV · common mode: ± 1 V · differential mode: ± 1 V
Bandwidth	:	0.5 Hz - 40 Hz at -3 dB
Heart rate range	:	10 to 300 b/min
Accuracy	:	± 5 b/min
Minimum QRS width	:	5 ms
Baseline correction after saturation	:	after 200 ms
QRS indicator	:	audio and visual

VF/VT Recognition

Shock recommendation	:	in the presence of VF/VT at a rate of over 180 b/min
Sensitivity	:	98.8 % (AHA and MIT)
Specificity	:	99.97 % (AHA and MIT)
Minimum amplitude required for ECG interpretation	:	ECG amplitude > 0.20 mV Signals with an amplitude < 0.2 mV are interpreted as asystole.

1. DESCRIPTION OF THE MULTIPULSE BIOWAVE FRED DEVICE

LCD Monitor

Specifications	:	· liquid crystal display (passive matrix), type FSTN · black and white · dimensions: 130 x 70 mm · 2 tracks
Display	:	· display of measurement values / alphanumeric settings · ECG curve (optional) · plethysmogram (optional)
Scrolling speed	:	25 mm/s (for ECG and plethysmogram)
Scrolling direction	:	left to right

Alarms

Technical alarms	:	· visual and audio
Physiological alarms	:	· visual and audio

Memory

Recording capacity	:	5 hours of ECG records and 500 events maximum for a 2 MB PCMCIA memory card or (optionally) one hour of ECG, one hour of the sound environment and 500 events for a 10 MB PCMCIA memory card.
PCMCIA card reading	:	either with the FREDWARE multimedia system or with the SAED Reader Pro software

SPO2 AND PULSE RATE

Inputs	:	Type CF, protected from defibrillation shocks
Sensor	:	finger sensor or Y sensor
Measuring range	:	0 to 100%
Accuracy	:	· ± 2 % from 70 to 99 % · ± 3 % from 50 to 69 %
Integration period	:	8 sec or 16 sec depending on the configuration
Signal intensity indicator	:	bar graph on the monitor
Amplitude adjustment	:	automatic gain

1. DESCRIPTION OF THE MULTIPULSE BIOWAVE FRED DEVICE

DEFIBRILLATOR PART

Electrodes

Type of electrode	:	single-use adhesive defibrillation electrodes
Inputs	:	insulated – type BF

Functions

Operating modes	:	· semiautomatic defibrillation (AED mode) · manual defibrillation in synchronised mode · manual defibrillation in non-synchronised mode
Energy value selection	:	· AED mode: semiautomatic function (AED mode) · Manual mode: selection by manual keyboard (optional)
Energy values in AED mode	:	· 130 J – 130 J – 180 J (energy delivered into 50 Ω) or on request · 90 J – 130 J – 180 J (energy delivered into 50 Ω)
Energy values available in Manual mode	:	· 1 - 2 - 4 - 6 - 8 - 15 - 30 - 50 - 70 - 90 -110 - 130 - 150 – 180 J (energy delivered into 50 Ω)
Energy accuracy	:	· ± 15 % (> 50 J) in 50 Ω · ± 4 J (≤ 50 J) in 50 Ω
Energy display	:	· selected energy value
Charge completed indication	:	· audio message · visual indication
Safety	:	· internal safety discharge displayed on monitor

Performance

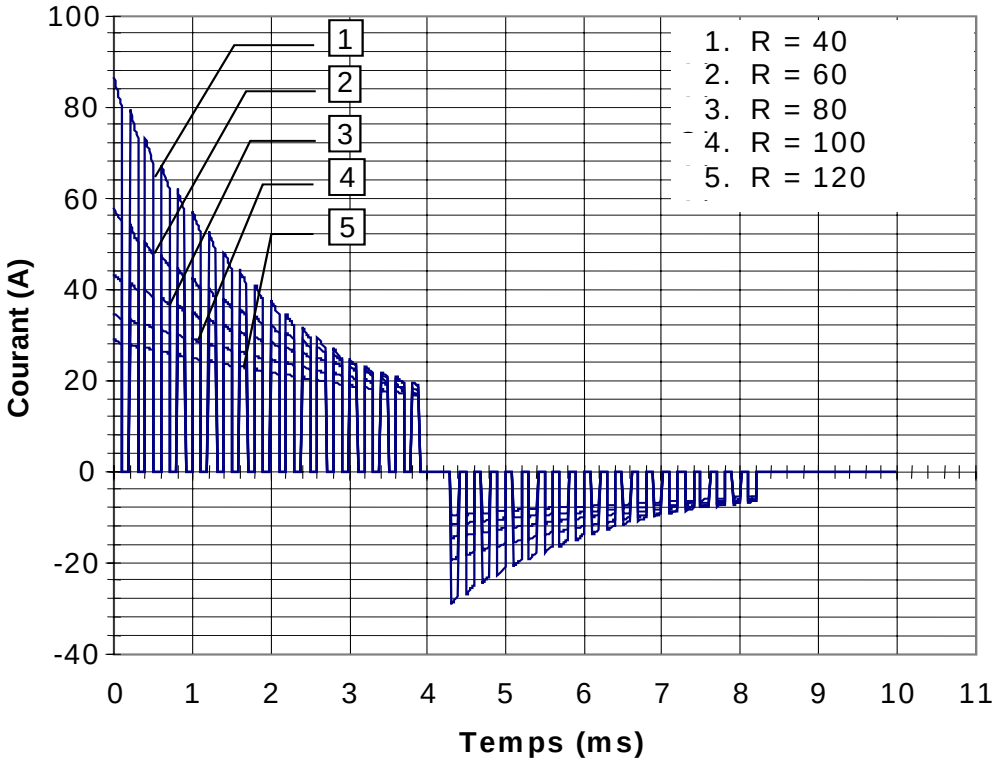
Nominal service	:	90 charges at maximum energy with no time gap between two charges (Cd/Ni battery fully charged)
Capacitor charging time		
· with full battery		· 5 sec with Cd/Ni or lithium cell
· after 15 discharges at maximum energy	:	· 6 sec with Cd/Ni or lithium cell
	:	
Discharge curve:	:	Biphasic waveform **MULTIPULSE BIOWAVE**
Discharge time into a resistance of 100 Ω	:	Phase 1 = 4 ms and Phase 2 = 4 ms Idle time = 400 µs between two phases

1. DESCRIPTION OF THE MULTIPULSE BIOWAVE FRED DEVICE

Discharge time into a resistance of 50 Ω	:	Phase 1 = 4 ms and Phase 2 = 4 ms Idle time = 400 µs between two phases
Synchronised shocks	:	25 ms after the R wave
Safety discharge	:	· 20 sec after charging · 160 ms after delivering the shock · if insufficient cell/battery charge capacity · if technical fault · when the device is switched off

Discharge curves at 180 Joules

Oscillogram of discharge into
40, 60, 80, 100 and 120 Ω resistance at maximum energy



DIMENSIONS AND WEIGHT

Dimensions	:	· Width: 260 mm · Height: 90 mm · Depth: 255 mm
Weight	:	· 2.9 kg (without battery or accessories) · 3.4 kg (with lithium cell) · 3.7 kg (with Cd/Ni battery)

1. DESCRIPTION OF THE MULTIPULSE BIOWAVE FRED DEVICE

PHYSICAL ENVIRONMENT REQUIREMENTS

Transport temperature range	:	-30 °C to +50 °C
Storage temperature range	:	-10 to +50°C
Operating temperature range	:	0 to +50°C
Relative humidity	:	30…95%, non condensing
Atmospheric pressure	:	700…1060 hPa
Protection class	:	· IP 20 without bag, with charger · IP 21 without bag, without charger · IP 23 with bag

1. DESCRIPTION OF THE MULTIPULSE BIOWAVE FRED DEVICE

1.3. FRED ACCESSORIES

1.3.1. BUFRDI

Optional ECG display. This option is used to view the ECG taken from the adhesive defibrillation electrodes or ECG electrodes on the monitor.

1.3.2. BUFRS

SpO_2 module. Optional module including the ECG display (BUFRDI) and that of the plethysmogram. Supplied with SpO_2 sensor and cable.

1.3.3. BUFREC3

Optional three-lead ECG module. This option is used to analyse the ECG from a three-lead cable. The BUFRDI module is required for viewing the ECG. Supplied with a three-lead ECG cable and electrodes.

1.3.4. BUFREC12

Optional twelve-lead ECG module. This optional module is used to acquire a twelve-lead ECG for transmission via GSM using special software. Modem (GSM) and software (SEMA 200) for an extra charge. The BUFRDI module is required to display a lead on the screen. Supplied with a ten-conductor ECG cable.

1.3.5. BUFRMAN

Optional manual defibrillation function. This optional function is used to operate the defibrillator in the manual mode: the user can select the energy value, set off capacitor charging and deliver the shocks. In the manual mode, shock synchronisation is integrated. The ECG display is also included and configurable.

1.3.6. FREDVO

Optional sound environment recording module. This module is used to record the voices of carers (30 min) in addition to the ECG and events. Supplied with 10 MB memory card. The FREDWARE system is required for reading.

1.4. OPTIONAL COMMUNICATION FEATURES

1.4.1. FREDWARE

Multimedia system for **FRED**®. The system includes a multimedia computer for reading (2 or 10 MB) PCMCIA cards directly or through a telephone link. Configured and tested. Supplied with a multimedia PC, 17" monitor, modem, PCMCIA drive and SAED Reader Pro software.

1.4.2. MODEM1

Modem for **FRED**®. The modem is configured for **FRED**® and is used to transmit the content of a memory card. The reception system is made up of READER 1 as a minimum.

1.4.3. MODEMGSM

Optional feature for transmitting the ECG by GSM. The GSM kit enables the **FRED**® device with the optional BUFREC12 module to transmit a complete ECG. The SEMA 200 reception software is available for an extra charge.

1.4.4. SEMA 200

Twelve-lead reception software. The SEMA 200 software makes it possible to view and archive the ECG transmitted by **FRED**® with the optional MODEMGSM and BUFREC12 modules.

1.4.5. READER 0

Memory card data transfer software. This SAED Reader Light freeware is used to transfer the content of the memory card to a PC via a serial link and a PCMCIA card. The software only offers the ECG display function. Compatible with Windows 95, 98 and NT.

1.4.6. READER 1

Memory card data transfer kit. The kit includes a PCMCIA reader, a security key and the SAED Reader Pro software. Installation is available for an extra charge. This complete version is used to transfer the content of the memory card to a PC (series link, PCMCIA, modem). Compatible with Windows 95, 98 and NT.

1.4.7. READER 2

Memory card data transfer kit for laptop PCs with PCMCIA drives. The kit includes a security key and the SAED Reader Pro software. This complete version is used to transfer the content of the memory card to a PC (series link, PCMCIA, modem). Compatible with Windows 95, 98 and NT.

1.5. CELLS, BATTERIES AND CHARGER FOR FRED

1.5.1. Mains charger for FRED®

* 77 592 230-V mains charger, Europe version, for **FRED**®
* 79 091 110-V mains charger, US version, for **FRED**®

The FRED mains charger offers slow charging (22 hours) of the cadmium-nickel battery by means of the mains. The FRED mains charger is also used to enable **MULTIPULSE BIOWAVE FRED**® to run in the monitoring mode on the mains power supply.

1.5.2. Vehicle charger for FRED

* W141 2013 Vehicle charger for **FRED**®

The vehicle charger for FRED offers slow recharging (22 hours) of the cadmium-nickel battery installed in FRED® by means of DC power taken from a vehicle. The vehicle charger is also used to enable **MULTIPULSE BIOWAVE FRED**® to run in the monitoring mode.

1.5.3. DG 2002 C2 charger

The DG 2002 C2 charger is used to rapidly recharge one or two cadmium-nickel batteries by means of the mains. The charger makes it possible to have fully charged cadmium-nickel batteries for **MULTIPULSE BIOWAVE FRED**® at all times.

1.5.4. BT 01 charger/discharger

The BT01 charger/discharger is used for the rapid charging and recycling of cadmium-nickel batteries by means of the mains.

1.6. ACCESSORIES

1.6.1. General accessories

*	U 16006	Ni/Cd – 12 V – 2.4 Ah battery
*	W141 5323	18 V – 4.75 Ah lithium cell (non rechargeable)
*	W140 5013	accessory bag
*	W140 5309	transport bag
*	W140 5045	Training CD-ROM for **FRED**®
*	W741 1927	ECG simulator for training, with electrodes
*	W140 5046	Training book for **FRED**®
*	W141 1876	PCMCIA memory card, capacity 2 MB
*	W141 1877	PCMCIA memory card, capacity 10 MB
*	W140 5307	vehicle wall mounting support for **FRED**® with the transport bag
*	W140 5367	vehicle wall mounting support for **FRED**® with no transport bag

*	W141 2108	connecting cable between **FRED**® and a PC (null modem series)

1.6.2. Defibrillation accessories

*	W141 0241	large single-use defibrillation electrodes for adults
*	W140 4262	large single-use defibrillation electrodes for children
*	W140 5424	defibrillation training electrodes, for use on a standard dummy only. These electrodes cannot be used for defibrillation.
*	W140 4811	Defibrillation cable for demonstration on dummy

1.6.3. ECG accessories

*	W140 9608	three-conductor ECG patient cable with clip (red, green, yellow) and 45° bent connector
*	U 50063	four-conductor ECG patient cable with clip (red, green, yellow) and 45° bent connector
*	W140 2037	ten-conductor ECG patient with 45° bent connector
*	W140 3846	three-conductor ECG patient cable for infants, with no clip (red, green, yellow), with 45° bent connector
*	72 365	adhesive ECG electrodes for adults, diameter 34 mm, bag of 50

1.6.4. SpO_2 accessories

*	U 50153	SpO_2 finger sensor for adults
*	U 50106	Oxilink SpO_2 sensor (Y type) for U 50105 finger cot
*	U 50105	finger cot for Oxilink sensor (Y type) U 50106
*	U 50072	two-metre SpO_2 extension cord

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*	W140 1977	soft SpO_2 sensor for infants, reusable
*	W140 2254	soft SpO_2 sensor for children, reusable
*	W140 2255	ear SpO_2 sensor
*	W140 2377	single-use SpO_2 finger sensor for adults (bag of 10)
*	W140 2378	adhesive single-use SpO_2 sensor for children weighing 15 – 45 kg (bag of 10)
*	W140 2379	adhesive single-use SpO_2 sensor for children weighing 3 – 15 kg (bag of 10)
*	W140 2380	adhesive single-use SpO_2 sensor for infants weighing less than 3 kg (bag of 10)
*	W140 2852	reusable adhesive tape for SpO_2 sensors (bag of 12)
*	W140 1994	single-use adhesive tape for soft SpO_2 sensors (bag of 40)

2. STARTING UP

This section describes the various possibilities of supplying power to the **MULTIPULSE BIOWAVE FRED®** device and charging the cadmium-nickel batteries and outlines some safety instructions to ensure correct device operation.

2.1. SAFETY INSTRUCTIONS

Danger! Risk of explosion

FRED® has not been designed for use in medical rooms with an explosive atmosphere.
Also, the defibrillator may not be used in oxygen-rich environments or in the presence of inflammable substances (petrol) or anaesthetics.
Avoid supplying oxygen to the area around the location of the defibrillation electrodes. Shut off any oxygen supply temporarily.

Warning! Risk of electrocution

The instructions below shall be followed strictly by all users. Any failure to follow the instructions could expose the patient, the user and rescue workers to the risk of death.

- **MULTIPULSE BIOWAVE FRED®** is a treatment device that uses high voltages. It may only be used by duly trained and qualified personnel**.** Any failure to use the device correctly could expose all the people concerned to the risk of death. Follow all the instructions provided in the operating manual.

- Before each use, the user shall make sure that the device is safe and in perfect working order (functional check), particularly by inspecting the cables, connections, electrodes and sensors for any sign of damage. Any defective part shall be replaced immediately.

- Take care to insulate the patient electrically (no direct contact with the other people present).

- Only connect devices to each other or the surrounding equipment if such connection does not jeopardise the safety of the patient, the user and the environment. If the technical specifications of different devices do not offer the certainty that they can be connected to each other safely, the user shall be responsible for contacting the manufacturers or a competent specialist in order to guarantee the safety of the patient, the user and the environment. In any event, the requirements of standard IEC 60601-1-1 / EN 60601-1-1 shall be met.

- In view of the requirements relating to devices protected from splashing water of standard IEC 60601 / EN 60601, the device may be used in a humid environment. However, avoid administering defibrillation shocks in very moist or wet environments.

- **MULTIPULSE BIOWAVE FRED®** devices may not be used outdoors along with the mains charger or the vehicle charger for FRED.

Warning! Risk of disrupting device operation

Device operation may be disrupted by the presence of magnetic or electrical fields. While using the device, check if all the other devices operating nearby meet all the relevant electromagnetic compatibility requirements. X-ray equipment, CAT scanners, radio transmitters and mobile telephones etc. may disrupt the operating of other devices as they are authorised to create more powerful electromagnetic fields.

Always keep such devices at an appropriate distance and always run a functional check before using the defibrillator.

Warning! Risk of disrupting other devices

Likewise, energy charging and the delivery of the defibrillation shock could disrupt the operating of other devices. Before proceeding, submit such other devices to a functional check.

Warning! Availability

MULTIPULSE BIOWAVE FRED® is designed for emergency use. As a result, it must be kept ready to operate at all times, regardless of the conditions of use. Always check the charge level of the battery or cell.

Warning! Risk of asphyxia

Take care to dispose of packaging materials in accordance with the applicable regulations and keep them out of the reach of children.

Warning! Risk of device damage

- Special care must be taken when HF surgery devices are used at the same time. As a principle, a minimum distance of 15 cm is to be kept between the ECG lead electrodes and the HF surgery or defibrillation electrodes. In the event of doubt, disconnect the patient cables (ECG acquisition) and the defibrillation electrodes while the HF surgery device is in use.

- Avoid setting off repeated shocks (in the Manual mode) when the electrodes are not connected to the patient. The internal safety discharge system that dissipates unneeded energy may lead to excess overheating

2.2. POWER SUPPLY

MULTIPULSE BIOWAVE FRED® may be powered by a rechargeable cadmium-nickel battery with a capacity of 2.4 Ah or by a non-rechargeable lithium cell with a capacity of 4.75 Ah.

- The cadmium-nickel battery offers independent operation for two and a half hours in the monitoring mode or the possibility to deliver 110 defibrillation shocks at 180 Joules.
- The lithium cell has an operating life of 5 hours in the monitoring mode or the possibility to deliver 450 defibrillation shocks at 180 Joules.

Notes

MULTIPULSE BIOWAVE FRED® cannot be started up without first inserting a correctly charged battery, even when the device is connected to the FRED® mains charger or vehicle charger.

MULTIPULSE BIOWAVE FRED® automatically monitors the charge capacity of the battery or cell. When the remaining charge level drops to the minimum required (30 minutes of operation or seven shocks at180 J), the BATTERY LOW symbol is displayed on the screen.

2.3. RECHARGING THE CADMIUM-NICKEL BATTERY

The cadmium-nickel battery can be recharged in the device itself by the mains charger or the vehicle charger for **FRED**®. The batteries may also be charged independently from the device with the help of an external DG 2002 C2 charger dedicated to cadmium-nickel batteries.

2.3.1. Mains charger for FRED®

Always recharge the cadmium-nickel battery after each use, and leave the **FRED**® mains charger connected all the time. There is no risk of overcharging the battery.

The mains charger offers two functions:
- slow recharging (in 27 hours) of the cadmium-nickel battery installed in **MULTIPULSE BIOWAVE FRED** when the device is off.
- ECG monitoring by **MULTIPULSE BIOWAVE FRED**®.

Recharging the cadmium-nickel battery with the mains charger

The recharging of the cadmium-nickel battery installed in **MULTIPULSE BIOWAVE FRED** only operates when the device is off.
To charge the cadmium-nickel battery by mean of the **FRED**® mains charger, start off by switching the device off, connect the charger connection cable to the corresponding connector on **MULTIPULSE BIOWAVE FRED**® and connect the mains charger to the mains.

- A cadmium-nickel battery (2.4 Ah) is recharged to 80% of its capacity in 20 hours, and to 100% in 27 hours via the **FRED**® mains charger.

ECG monitoring with the mains charger

The mains charger for **FRED**® also enables ECG monitoring with **MULTIPULSE BIOWAVE FRED**®. For such monitoring, just connect **MULTIPULSE BIOWAVE FRED**® to the mains charger for **FRED**® and start up the device (which will be powered by the mains).

Important notes:
When Multipulse Biowave FRED® is powered through the mains charger for FRED®, the defibrillation function is not available and the recharging of the cadmium-nickel battery in place is not guaranteed. Besides, in some conditions of use, the device may generate a low battery alarm message - the message is to be ignored.

- **While using MULTIPULSE BIOWAVE FRED® in the monitoring mode through the mains charger for FRED®, users are recommended not to charge the high-voltage capacitor: in either of the two modes, manual or AED.**
- **However, if you do start charging the high-voltage capacitor, charging will not be effective and the device will either be switched off or display error messages. To cancel the error messages, the device must be switched off with the On/Off key.**

2.3.2. Vehicle charger for FRED®

The vehicle charger for **FRED**® also performs two functions:
- slow recharging (in 27 hours) of the cadmium-nickel battery installed in **MULTIPULSE BIOWAVE FRED**®.
- ECG monitoring by **MULTIPULSE BIOWAVE FRED**®.

Recharging the cadmium-nickel battery with the vehicle charger

The recharging of the cadmium-nickel battery installed in **MULTIPULSE BIOWAVE FRED**® does not depend on the device status. The device is recharged, whether it is on or off.
To charge the cadmium-nickel battery by mean of the **FRED**® vehicle charger, connect the vehicle charger connection cable to the corresponding connector on **MULTIPULSE BIOWAVE FRED**® and connect the vehicle charger to the DC supply of the vehicle (mind the polarity).

- A cadmium-nickel battery (2.4 Ah) is recharged to 80% of its capacity in 20 hours, and to 100% in 27 hours via the **FRED**® vehicle charger.

ECG monitoring with the vehicle charger

The vehicle charger for **FRED**® also enables ECG monitoring with **MULTIPULSE BIOWAVE FRED**®. For such monitoring, just connect **MULTIPULSE BIOWAVE FRED**® to the vehicle charger for **FRED**® and start up the device (which will be powered by the vehicle).

Important notes:
When MULTIPULSE BIOWAVE FRED® is powered by the FRED® vehicle charger, the defibrillation function is not available.

- **While using MULTIPULSE BIOWAVE FRED® in the monitoring mode through the vehicle charger for FRED®, users are recommended not to charge the high-voltage capacitor: in either mode – manual or AED – or when there is no battery.**
- **However, if you do start charging the high-voltage capacitor, charging will not be effective and the device will either be switched off or display error messages. To cancel the error messages, the device must be switched off with the On/Off key.**

2.3.3. DG 2002 C2 charger

The DG 2002 C2 charger is used for rapidly recharging one or two cadmium-nickel batteries. It has been designed specially for such batteries and offers the following advantages:

- optimised charging performance and
- a longer life for cadmium-nickel batteries.

To charge one or two cadmium-nickel batteries with the DG 2002 C2 charger, connect the charger to the mains. Switch on the DG 2002 C2 charger (switch located below the mains cord connector) and insert a battery in one of the two slots. Rapid charging starts as soon as the battery is inserted (the indicator goes on). Recharging a fully discharged battery takes one hour. When the cadmium-nickel battery is fully charged, the console switches to the continuous charge mode (the indicator flashes).

A cadmium-nickel battery can be charged to 100% of its capacity in one hour with the DG 2002 C2 charger, which offers a controlled charging facility.

Notes:

While the battery is being recharged, never expose it to direct sunlight or place it on a radiator. Also, avoid exposing it to temperatures below +5°C. The surrounding temperature may not exceed +40°C as exposure to excessively high temperatures could have an adverse effect on the total life of the battery.

3. OPERATION

This section describes the field of use of the device and the basic principles of the chain of survival. For more information about the use of the device and its context of use, it is imperative to refer to the Operating Manual of the **FRED**® device.

In its basic version, **MULTIPULSE BIOWAVE FRED**® is a battery-operated compact biphasic semiautomatic defibrillator. Defibrillation is achieved by means of large single-use adhesive defibrillation electrodes, which also acquire the ECG signal in order to analyse and measure the heart rate.
When the device is in use, the user is guided by visual and audio instructions (LCD screen and speaker).
For documentation and analysis, the device can save up to 5 hours of the ECG signal and the intervention procedure on its PCMCIA memory card.

The use of this device in the semiautomatic defibrillation mode (or AED mode) is only permitted if the legislation of the country of use expressly provides for early defibrillation by non-medical personnel. The personnel shall be trained specially and placed under the control of a physician.

A special variant of the device offers the possibility to use the **MULTIPULSE BIOWAVE FRED**® device for manual defibrillation.

In principle, the use of this device is part of the "chain of survival" developed by the American Heart Association (AHA) and the European Resuscitation Council (ERC). The chain of survival is represented by a succession of steps taken by different protagonists, all of whom play an essential role in offering continuous care to victims of sudden cardiac arrests. Such care is indispensable in order to improve the chances of survival of such patients. Time is of the essence in the chain of survival. It is generally accepted that the chain of survival includes several complementary integrated steps, which are as follows:

1. Recognition of cardiac arrest

2. Early access

3. Early CPR (cardiac-pulmonary resuscitation)

4. Early defibrillation where required

5. Early advanced life support

6. Hospitalisation in intensive care

The people involved in the chain are as follows:

- witnesses
- first-aid workers
- medical teams: paramedics or out-of-hospital medical personnel
- hospital teams

3. OPERATION

The effectiveness of the entire chain of survival can be jeopardised if any of its links were to fail.

Note relating to biocompatibility

The product components and accessories described in this manual that come in contact with the patient during the proper use of the product are designed to fulfil all the requirements of biocompatibility standards. For any questions on this matter, do not hesitate to contact Schiller.

☞ **The correct procedure for using MULTIPULSE BIOWAVE FRED® has been provided in the FRED® operating manual.**

4. TESTING AND MAINTENANCE

This section describes the testing and maintenance procedures recommended for **MULTIPULSE BIOWAVE FRED®**.

4.1. FUNCTIONAL INSPECTIONS

As regards functional checking, the device offers two different testing possibilities:

- Automatic testing upon power up
- Manual test

4.1.1. Automatic testing upon power up

When the device is switched on, the self test screen appears and the automatic test takes place.

The automatic self test upon power up includes the following:
- main processor working memory check (read, write)
- main processor check (internal memory, arithmetic operations)
- program medium check (8-bit CRC)
- analogue/digital converter check (verification of power supply voltages)
- ECG amplifier module check (internal self test)
- VF/VT recognition module test (internal self test)
- recording module check (internal self test)
- defibrillator check (with no high-voltage capacitor charge)
- cadmium-nickel battery or lithium cell charge test

If the device does not find any error, it switches to the AED mode and prompts the user to connect the large defibrillation electrodes.

On the other hand, if the device detects an error, an audio alarm sounds and an error message is displayed. In that case, switch off the device or the power supply to the device (remove the battery or cell). The device may only be used again after it has been repaired.

Note

- An error in the data recording module (PCMCIA memory card) does not have any effect on correct device operation. Once the test has been completed, the device switches to the AED mode. To signal the error detected, the recording symbol flashes.

- A complete functional check of the high-voltage capacitor discharge circuit (energy discharge test) can only be performed with an appropriate test simulator (see p 4.2). The simulator must generate a fibrillation ECG signal and have a circuit to measure the energy delivered during a biphasic defibrillation shock.

Warning! Risk of electrocution

- In addition to a successful self test, remember to visually check all the cables, connections, electrodes and sensors before each use. If the inspection brings out any defects that could reduce the safety of the patient or user, the device may not be used before it is repaired.

Precautions required while testing the device

While testing the MULTIPULSE BIOWAVE FRED device, only fixed resistors with high voltage and power ratings that are well insulated from the frame and the earth may be used to simulate the patient. Never use incorrectly insulated systems, systems with loose contacts or systems with components such as sparkers or flash tubes, as they could destroy the device beyond repair.

4.1.2. Manual testing

Manual tests can be set off at any time while switching on the device, by pressing the On/Off and Contrast - keys at the same time.
To set off the manual test, switch off the device if it is on. Press the Contrast – key and press the On/Off key with the Contrast – key pressed in. **MULTIPULSE BIOWAVE FRED®** will switch to the manual test mode and the manual test screen will be displayed. First of all, the device runs an internal test of the various functions and then tests the various keypads. Follow the instructions provided on the screen and press the required keys as told.

Manual testing includes the following:
- main processor working memory check (read, write)
- main processor check (internal memory, arithmetic operations)
- program medium check (8-bit CRC)
- analogue/digital converter check (verification of power supply voltages)
- ECG amplifier module check (internal self test)
- VF/VT recognition module test (internal self test)
- recording module check (internal self test)
- defibrillator check (with high-voltage capacitor charge)
- cadmium-nickel battery or lithium cell charge test
- check of the various keypads (interactive check with the operator)
- LCD monitor check

If the manual test is successful, the device goes off automatically at the end of the test.

If **MULTIPULSE BIOWAVE FRED®** detects an error during the manual test, it transmits an audio alarm till the device is switched off by the operator (pressing the On/Off key or removing the battery).

Note
- You can interrupt the manual test at all times by pressing the Off key of the device.

- Users are advised to run the manual test every time the cell or battery is changed, in order to check the charge level.

4.2. AUTOMATIC DAILY TEST

In order to ensure that the device is available for use, it runs an automatic functional test every day. Every day at 12.00, **MULTIPULSE BIOWAVE FRED**® runs an automatic daily test even when it is off (monitor off). The automatic daily test procedure is identical to the self test upon power up, with the exception of the defibrillator part test, which includes a charge of the high-voltage capacitor in this case.

The automatic daily test includes the following:

- main processor working memory check (read, write)
- main processor check (internal memory, arithmetic operations)
- program medium check (8-bit CRC)
- analogue/digital converter check (verification of power supply voltages)
- ECG amplifier module check (internal self test)
- VF/VT recognition module test (internal self test)
- recording module check (internal self test)
- defibrillator check with high-voltage capacitor charge
- cadmium-nickel battery or lithium cell charge test

If the automatic daily test is successful, the device goes off automatically at the end of the test.

If **MULTIPULSE BIOWAVE FRED**® detects an error during the automatic daily test, it generates a sound alarm after every two minutes and briefly displays an error message.

To stop the alarm, the operator has to start the manual test (see 4.1.2).

Note

- With a fully charged cadmium-nickel battery, the device can perform this daily check for at least 4 weeks.

4.3. SYSTEMATIC INSPECTION BEFORE USE

Before each use, users are advised to visually inspect the device, the cables, the connectors and the electrodes.

If any defect or malfunctioning is found that could jeopardise the safety of the patient or user, do not use the device before it is repaired.

– Systematic check before each use
  - device housing condition check
  - no mechanical damage
  - no penetration of liquid in the device
  - soft keypad and connector condition check

4.4. WEEKLY CHECK

MULTIPULSE BIOWAVE FRED® is an emergency device that must be available for use at all times. The checks below are to be performed at regular intervals:

- Weekly inspection
  - device housing condition check
  - connector and cable insulator condition check
  - accessory completeness check

4.5. YEARLY CHECK

The after-sales service of Schiller can take charge of checking **MULTIPULSE BIOWAVE FRED®** devices once a year as part of a maintenance agreement. Otherwise, make sure that the checks are performed by personnel who are trained and have the experience and qualifications required for such operations.

- Yearly check:
  - visual inspection of the device to locate any mechanical damage Immediately replace any damaged parts.
  - check of the legibility of safety instructions Replacement of any missing or illegible marking
  - check of the presence and legibility of a brief operating manual.
  - functional device check by means of a manual test
  - leakage current measurement to IEC 60601-2-4
  - measurement of the energy delivered by the defibrillator (see precautions while testing the device, p. 4.2)
  - careful check of the electrode cables for any mechanical faults, short circuits or cuts

Other than the checks and inspections outlined above, **MULTIPULSE BIOWAVE FRED®** does not require any special maintenance.

4.6. CLEANING AND DISINFECTING

Caution:	**Switch the device off before cleaning it. Remove the battery or cell before starting to clean the device in order to rule out the risk of starting it up accidentally. Disconnect the defibrillation electrode cables from the device before cleaning.** **No liquid may be allowed to penetrate inside the device. However, if that does happen, the device may not be used before it is verified by the Customer service department.**

Never clean the device or the electrodes with substances such as ether, acetone, esters or aromatic chemicals.
Never use phenol-based agents or agents containing peroxide derivatives to disinfect the surfaces of the housing of the device.

- Dispose of all single-use electrodes immediately after use in order to eliminate any risk of accidental reuse (hospital waste disposal system).

- Before cleaning the sensor and electrode cables, disconnect the cables from the device. For cleaning and disinfecting the cables, wipe them down with a piece of gauze moistened with cleaner or disinfectant. Never immerse the connectors in a liquid. You may use any cleaning or disinfecting solution that is commonly used in hospitals.

- Proceed likewise with the housing, with a cloth moistened with cleaner or disinfectant. No liquid may be allowed to penetrate inside the device during this operation.

5. TROUBLESHOOTING

This section describes the troubleshooting procedure to be used if **MULTIPULSE BIOWAVE FRED®** fails to operate correctly. If you have trouble locating or correcting the fault, contact the Customer service department of Schiller.

Precautions required during troubleshooting

While testing the MULTIPULSE BIOWAVE FRED device, only fixed resistors with high voltage and power ratings that are well insulated from the frame and the earth may be used to simulate the patient. Never use incorrectly insulated systems, systems with loose contacts or systems with components such as sparkers or flash tubes, as they could destroy the device beyond repair.

PROBLEM	CAUSES	CORRECTIVE ACTION
Battery	Battery worn down	Test the battery: run 15 charging/discharging cycles at 180 J on an external charge (e.g. a joulemeter) in series of 5 with a five-minute gap. If a charge takes more than 15 seconds, the battery must be changed.
The device starts incorrectly and/or does not reach its normal operating mode	1. Exceptional error 2. Operating error 3. Battery too low 4. CPU board 5. TWELVE-LEAD ECG AMP board	1. Switch off the device, then on again. 2. Check the instructions and try again. 3. Make sure that the battery is sufficiently charged. 4. Change the CPU board 5. Change the TWELVE-LEAD ECG AMP board.
The device cannot be switched on	1. Battery flat or absent 2. Battery incorrectly inserted 3. Defective On/Off button 4. F1 fuse 5. POWER SUPPLY board 6. High-voltage PCB 7. CPU board	2. Recharge or replace the battery 2. Check the battery connection with the battery interface board 3. Check the On/Off button 4. Change fuse F1 on the high-voltage PCB 5. Change the POWER SUPPLY board 6. Change the high-voltage PCB 7. Change the CPU board
The high-voltage capacitor takes more than 15 seconds to charge to 180 J	1. Battery flat 2. Battery worn down 3. High-voltage PCB 4. High-voltage capacitor 5. HIGH-VOLTAGE SWITCHING board	1. Recharge or replace the battery 2. See Battery problem. 3. Change the high-voltage PCB 4. Change the high-voltage capacitor 5. Change the HIGH-VOLTAGE SWITCHING board

5. TROUBLESHOOTING

PROBLEM	CAUSES	CORRECTIVE ACTION
The high-voltage capacitor does not charge correctly	1. Battery flat 2.High-voltage and DEFIBRILLATOR CONTROL PCBs 3. CPU board 4. HIGH-VOLTAGE SWITCHING board	1. Recharge or replace the battery 2. Change the high-voltage and DEFIBRILLATOR CONTROL PCBs 3. Change the CPU board 4. Change the HIGH-VOLTAGE SWITCHING board
The defibrillator does not charge	1. Operating error 2. Battery flat 3. The high-voltage capacitor is incorrectly connected 4. Fuse F3 5. High-voltage and DEFIBRILLATOR CONTROL PCBs 6. HIGH-VOLTAGE SWITCHING board	1. Repeat the operation 2. Recharge or replace the battery 3. Check the connection of the high-voltage capacitor 4. Change fuse F3 on the high-voltage PCB 5. Change the high-voltage and DEFIBRILLATOR CONTROL PCBs 6. Change the HIGH-VOLTAGE SWITCHING board
The energy delivered is incorrect	1. Operating error 2. The joulemeter is providing an incorrect value	1. Check the instructions and try again. 2. Make sure that the Joulemeter is compatible with pulsed discharge or use an insulated current sensor and measure the defibrillation current.
The pulse biphasic waveform is changed	1. High-voltage and DEFIBRILLATOR CONTROL PCBs 2. HIGH-VOLTAGE SWITCHING board	1. Change the high-voltage and DEFIBRILLATOR CONTROL PCBs 2. Change the HIGH-VOLTAGE SWITCHING board
Loss of date and time	1. Clock upset 2. Backup cell flat: REPLACE AFTER TEN YEARS 3. CPU board	1. Set the clock as instructed in the operating manual and switch on the device. 2. Change the lithium cell on the CPU board 3. Change the CPU board
Message: 001 : 'ECG RECEPTION TIMEOUT'	Major error – return the device for repairs	
Message: 101 : FV RECEPTION TIMEOUT'	Major error – return the device for repairs	
Message: 102 : 'SAED AUTOMATON ERROR'	Major error – return the device for repairs	
Message: 202 : DEFI AUTOMATON ERROR'	Major error – return the device for repairs	

5. TROUBLESHOOTING

PROBLEM	CAUSES	CORRECTIVE ACTION
Message: 301 : DISPLAY AUTOMATON ERROR'	Major error – return the device for repairs	
Message: 401 : ALARM ID OUT OF RANGE'	Major error – return the device for repairs	
Message: 501 : 'CMD FIFO SCRATCH ERROR'	Major error – return the device for repairs	
Message: 502 : MEMORY RECEPTION TIMEOUT'	Major error – return the device for repairs	
Message: '605: SPO2 TRANSMISSION ERROR'	Major error – return the device for repairs	
Message: '701: 'EEPROM WRITE ERROR'	Major error – return the device for repairs	
Message: '801: EXT MODEM TRANS ERROR'	Major error – return the device for repairs	
Message: '802: EXT AUTOMATON ERROR'	Major error – return the device for repairs	
Message: 'BATTERY LOW'	1. Battery flat 2. CPU board	1. Recharge or replace the battery 2. Change the CPU board
Message: Inappropriate asystole	1. Electrode connection 2. Exceptional error 3. Electrodes 4. ECG PREAMP PROTECTION board 5. Twelve-lead defibrillation ECG amp board 6. CPU board	1. Check the connection between the electrodes and the device. 2. Switch off the device, then on again. 3. Change the electrodes 4. Change the ECG PREAMP PROTECTION board 5. Change the twelve-lead defibrillation ECG amp board. 6. Change the CPU board

5. TROUBLESHOOTING

PROBLEM	CAUSES	CORRECTIVE ACTION
Message: 'SENSOR'	1. SpO2 sensor connection 2. Exceptional error 3. SpO2 sensor 4. SpO2 board 5. CPU board	1. Check the connection between the sensor and the device 2. Switch off the device, then on again. 3. Change the SpO2 sensor 4. Change the SpO2 board 5. Change the CPU board
Message: 'ELECTRODE FAULT'	1. Electrode connection 2. Exceptional error 3. Electrodes 4. ECG PREAMP PROTECTION board 5. CPU board	1. Check the connection between the electrodes and the device. 2. Switch off the device, then on again. 3. Change the electrodes 4. Change the ECG PREAMP PROTECTION board 5. Change the CPU board
Message: 'BATTERY ERROR'	1. Battery connection 2. Battery flat	1. Check the battery connection 2. Recharge or replace the battery
Message: 'ADC ERROR'	1. Exceptional error 2. CPU board	1. Switch off the device, then on again. 2. Change the CPU board
Message: 'CPU ERROR'	1. Exceptional error 2. CPU board	1. Switch off the device, then on again. 2. Change the CPU board
Message: 'DEFI ERROR'	1. Exceptional error 2. HIGH-VOLTAGE PCB 3. DEFIBRILLATOR CONTROL board 4. HIGH-VOLTAGE SWITCHING board 5. CPU board	1. Switch off the device, then on again 2. Change the high-voltage PCB 3. Change the DEFIBRILLATOR CONTROL PCB 4. Change the HIGH-VOLTAGE SWITCHING board 5. Change the CPU board
Message: 'ECG ERROR'	1. Exceptional error 2. TWELVE-LEAD ECG AMP board 3. CPU board	1. Switch off the device, then on again 2. Change the TWELVE-LEAD ECG AMP board. 3. Change the CPU board
Message: 'EEPROM ERROR'	1. Exceptional error 2. EEPROM problem 3. CPU board	1. Switch off the device, then on again 2. Change the CPU board 3. Change the CPU board
Message: 'EPROM ERROR'	1. Exceptional error 2. EPROM problem 3. CPU board	1. Switch off the device, then on again 2. Change the EPROM modules 3. Change the CPU board

5. TROUBLESHOOTING

PROBLEM	CAUSES	CORRECTIVE ACTION
Message: 'MEMORY ERROR'	1. Exceptional error 2. CPU board	1. Switch off the device, then on again 2. Change the CPU board
Message: 'RAM ERROR'	1. Exceptional error 2. RAM problem 3. CPU board	1. Switch off the device, then on again 2. Change the CPU board 3. Change the CPU board
Message: 'FV ERROR'	1. Exceptional error 2. VF microcontroller 3. CPU board	1. Switch off the device, then on again 2. Change the VF EPROM 2. Change the CPU board
Message: 'PULSE'	1. SpO2 sensor connection 2. SpO2 sensor 3. Exceptional problem 4. SpO2 board 5. CPU board	1. Check the connection between the sensor and the device 2. Change the SpO2 sensor 3. Switch off the device, then on again 4. Change the SpO2 board 5. Change the CPU board
Inappropriate or incomprehensible message	1. Exceptional error 2. CPU board	1. Switch off the device, then on again 2. Change the CPU board
Inappropriate or incomprehensible audio message	1. Exceptional error 2. CPU board	1. Switch off the device, then on again 2. Change the CPU board
No audio messages	1. Exceptional error 2. Device set-up 3. Speaker connection 4.Voice microcontroller 5. CPU board	1. Switch off the device, then on again 2. Check if the sound is on 3. Check the speaker connection 4. Change the Voice EPROM 5. Change the CPU board
Incorrect ECG signal	1. Exceptional error 2. Loose contact 3. Electrodes 4. TWELVE-LEAD ECG AMP board 5. DEFIBRILLATION ECG PREAMP board 6. ECG PREAMP PROTECTION board 7. CPU board	1. Switch off the device, then on again 2. Check the contact between the electrodes and the device 3. Change the electrodes 4. Change the TWELVE-LEAD ECG AMP board. 5. Change de DEFIBRILLATION ECG PREAMP board 6. Change the ECG PREAMP PROTECTION board 7. Change the CPU board

5. TROUBLESHOOTING

PROBLEM	CAUSES	CORRECTIVE ACTION
No data stored on memory card	1. The memory card is full 2. The memory card is write-protected	1. The corresponding icon is flashing: transfer the content of the memory card with the Reader software 2. A crossed-out icon is flashing on the monitor: change the position of the micro switch at the rear of the memory card to set it to the W/P off position
When the device is connected to the mains charger, the battery does not charge	1. The device is on 2. Connection with the charger 3. Fuse F2 4. High voltage board wiring 5. High voltage board	1. Switch off the device 2. Check the connection with the charger 3. Change fuse F2 on the high-voltage board 4. Check the wiring of external DC connector 5. Change the high-voltage PCB
When the device is connected to the mains charger, the defibrillator does not operate	The defibrillator cannot operate with the mains charger when there is no battery.	1. Put in a charged battery
When the device is connected to the mains charger, there are alarm messages or the device is switched off when you try to charge the capacitor	The defibrillator cannot operate with the mains charger when there is no battery.	1. Switch off the device if it is still on. 2. Put in a charged battery
When the device is connected to the vehicle charger, the battery does not charge	1. Connection with the charger 2. Vehicle charger 3. Fuse F2 4. High voltage board wiring 5. High voltage board	1. Check the connection with the charger 2. Check the vehicle charger 3. Change fuse F2 on the high-voltage board 4. Check the wiring of external DC connector 5. Change the high-voltage PCB
When the device is connected to the vehicle charger, the defibrillator does not operate	The defibrillator cannot operate with the vehicle charger when there is no battery.	1. Put in a charged battery
When the device is connected to the vehicle charger, there are alarm messages or the device is switched off when you try to charge the capacitor	The defibrillator cannot operate with the vehicle charger when there is no battery.	1. Switch off the device if it is still on. 2. Put in a charged battery

6. REPLACEMENT OF PARTS

This section describes how to dismantle the device in order to replace faulty parts. The warnings below apply to all operations on internal device components.

Warning:	**MULTIPULSE BIOWAVE FRED® is a defibrillator with a high-voltage capacitor that can be charged to a fatal voltage. The device may only be disassembled by specially trained and authorised personnel.**

Caution:	**Before disassembling the device, remove the battery or cell from its slot.**

Caution:	**The device contains circuits sensitive to electrostatic discharge. All operations on MULTIPULSE BIOWAVE FRED® shall be performed in accordance with applicable ESD rules. The operations shall be carried out on an antistatic mat connected to the earth, and the operator shall wear an antistatic strap connected to the mat. Remove the antistatic strap while working on the high-voltage part of the defibrillator.**

Caution:	**The device shall undergo a general test every time it is opened.**

6.1. DEVICE DISASSEMBLY PROCEDURE

Follow the instructions below while disassembling the device:

1. Remove the cadmium-nickel battery or lithium cell from its slot

2. Also remove the mains or vehicle charger cable if the charger is connected to **MULTIPULSE BIOWAVE FRED®**.

3. Disconnect all the electrode or SpO2 cables.

4. Turn the device over (LCD monitor down) and unscrew the six assembly screws of the bottom and top halves of the housing.

5. After removing the six screws, turn the device over (LCD monitor towards you).

6. The upper and lower halves of the housing can now be separated. Lift off the upper half and place it to the rear of the lower half by clearing the loop of the ribbon cable located inside the CPU shield (18) of the upper half.

7. The two parts can be separated by disconnecting the three cables that connect them:
   - Disconnect the flat 34-conductor cable with the help of the connector locking clips accessible in the lower half
   - Carefully disconnect the flat 10-conductor cable from the connector in the top half
   - Carefully disconnect the shielded 5-conductor cable of the connector that is partly hidden under the insulation piece (25) of the upper half.

At this point, the two halves are completely separated. Now you can work on the upper part (monitor function) or the lower part (defibrillator function).

6.2. OPERATIONS ON THE UPPER PART

While working on the upper part, use the references to the drawing titled “Upper housing assembly”. In order to access the various components in the upper part, you must first remove the shielding cover (18) of the CPU board, which is fixed by six screws.

6.2.1. Removing the CPU circuit

After removing the shielding cover (18), the CPU PCB is entirely accessible. Place the upper part flat (LCD screen down) with its rear wall turned towards you (the handle towards the back of the workstation). To remove the CPU board (5) from the upper part, follow the indications below:

1. Carefully remove the flat cable (10 conductors) from its base J3 located close to the rear left corner of the upper part.

2. Also remove the AMP connector connected to the BACKLIGHTING PCB.

3. Lift the CPU board from the side of the notch on the right-hand side of the board and disconnect the connection between cards (with the LCD screen) at that location.

4. Pull the CPU board to the right in order to remove the ejectors of the memory card support from the memory card notch protected by the soft cap (3).

5. Turn the CPU board over so that the side marked Top Side rests on the upper part towards the handle.

6. Remove the various flat jumpers from their respective bases (i.e. J12, J8 and J6 from left to right). **MULTIPULSE BIOWAVE FRED**® devices with an optional manual defibrillation function also have an interconnected jumper at J7.

7. After the above steps have been completed, the CPU board can be removed from the upper part.

Caution:	**This circuit contains components sensitive to electrostatic discharge. The operation described above shall be performed in accordance with applicable ESD rules.**

The CPU board has a lithium cell for saving the various settings. The cell continues to power some circuits even when the CPU board is completely disconnected from the device.
The backup lithium cell must be replaced after ten years of service.

6.2.2. Removing the LCD display

Once the CPU board is removed (see relevant section), the LCD display is entirely accessible. Place the upper part flat (LCD screen down) with its rear wall turned towards you (the handle towards the back of the workstation). To remove the LCD display (28) from the upper part, follow the instructions below:

1. Carefully remove the connector connected to the base (CP2) of the BACKLIGHT CONVERTER support board.

2. Unscrew the two monitor fixing pieces (handle side of the upper part).

3. Unscrew the two screen fixing screws (on the side of the patient preamp insulation piece, 25)

4. Once these steps have been taken, the LCD monitor can be removed from the upper part.

Caution:	**This circuit contains components sensitive to electrostatic discharge. The operation described above shall be performed in accordance with applicable ESD rules.**

If the LCD monitor is being changed, ensure that the new screen and the protective piece (31) are clean. Never wipe the surface of an LCD monitor with cloth or paper that could be slightly abrasive, as that would scratch the screen. Any dust may be removed by blowing with compressed air.

6.2.3. Removing the BACKLIGHT CONVERTER support circuit

In order to gain access to the backlight converter support circuit, you must also remove the CPU board. After removing the CPU board (see relevant section), you have access to the backlight converter support PCB. Place the upper part flat (LCD screen down) with its rear wall turned towards you (the handle towards the back of the workstation). To remove the BACKLIGHT CONVERTER support circuit (9) from the upper part, follow the instructions below:

1. Carefully remove the connector connected to the base (CP2) of the BACKLIGHT CONVERTER support board.

2. Unscrew the three fixing screws of the backlighting converter board.

3. When the steps above have been completed, the BACKLIGHT CONVERTER support circuit can be removed from the upper part.

6.2.4. Removing the DEFIBRILLATION ECG PREAMP circuit

After the CPU board has been removed (see relevant section), the insulation and shielding enclosure (25) of the ECG preamp circuits is accessible. Place the upper part flat (LCD screen down) with its rear wall turned towards you (the handle towards the back of the workstation). To remove the DEFIBRILLATION ECG PREAMP circuit (6) from the upper part, follow the instructions below:

1. Remove the two adhesive tapes that close the insulation and shielding enclosure (25) of the ECG preamp circuits.

2. After opening the enclosure, remove the insulating piece (24) from the DEFIBRILLATION ECG PREAMP PCB.

3. Unscrew the four screw that hold the DEFIBRILLATION ECG PREAMP PCB.

4. Turn the DEFIBRILLATION ECG PREAMP PCB over and carefully pull flat cable (10 conductors) out of base J1.

5. After the above steps have been completed, the DEFIBRILLATION ECG PREAMP board can be removed from the upper part.

Caution:	**This circuit contains components sensitive to electrostatic discharge. The operation described above shall be performed in accordance with applicable ESD rules.**

To replace the DEFIBRILLATION ECG PREAMP PCB, proceed as described above for removal. While reassembling the board, take care to put in the insulation piece (24) before you close the insulation and shielding enclosure (25). Put in place the two adhesive tapes in order to keep the enclosure closed.

Caution:	**The impedance setting must be made imperatively with potentiometer P1 of the DEFIBRILLATION ECG PREAMP board.**

6.2.5. Removing the TWELVE-LEAD ECG AMP circuit

After the CPU and DEFIBRILLATION ECG PREAMP PCBs have been removed (see relevant sections), the TWELVE-LEAD ECG AMP circuit becomes accessible at the bottom of the insulation and shielding enclosure. Place the upper part flat (LCD screen down) with its rear wall turned towards you (the handle towards the back of the workstation). To remove the TWELVE-LEAD ECG AMP PCB (7) from the upper part, follow the instructions below:

1. Remove the defibrillator ECG preamp PCB and remove the two tapes remaining on the insulation and shielding enclosure (25) on the left-hand side.

2. Also remove the copper-coated conducting adhesive tape applied along the closing edge of the insulation and shielding enclosure.

3. After opening the enclosure, remove the insulation piece (26) from the TWELVE-LEAD ECG AMP PCB.
4. Unscrew the two screws used to fix the TWELVE-LEAD ECG AMP PCB (left-hand side of the board).
5. Also unscrew the two fixing pieces of the TWELVE-LEAD ECG AMP PCB (right-hand side of the board).
6. Remove the cable interconnected with CP1 on the TWELVE-LEAD ECG AMP PCB.
7. Now you can remove the TWELVE-LEAD ECG AMP PCB from the upper part.

Caution:	**This circuit contains components sensitive to electrostatic discharge. The operation described above shall be performed in accordance with applicable ESD rules.**

If the TWELVE-LEAD ECG AMP PCB is to be replaced, proceed as described above for disassembly. While reassembling the board, make sure that the insulating piece (26) has been installed correctly. Also make sure that the flat cable (interconnection with the DEFIBRILLATION ECG PREAMP circuit) has been fed through the slot provided before closing the insulation and shielding (25) enclosure. Put it place a copper-coated conducting tape along the edge (left-hand side of the board) and the two adhesive tapes to keep the enclosure closed.

6.3. OPERATIONS ON THE LOWER PART

Caution:	**Before starting to work on the lower part, make sure that the lithium cell or the cadmium-nickel battery is not in the slot.**

While working on the lower part, use the references in the drawing titled “Exploded view of biphasic pulse”. In order to have access to the components of the lower part, you must first remove the insulation and shielding circuit (24) that is fixed by seven screws, which covers the entire defibrillator part. While removing the INSULATION AND SHIELDING circuit which is connected to the insulating piece (45), take care to clear the shielded cable.

6. REPLACEMENT OF PARTS

Warning:	**MULTIPULSE BIOWAVE FRED® is a defibrillator with a high-voltage capacitor that can be charged to a fatal voltage. The lower part of the device contains all the components of the defibrillator part. The device may only be disassembled by specially trained and authorised personnel.**

Warning:	**Before disassembling the lower part, it is imperative to make sure that the high-voltage capacitor is fully discharged. Refer to the point below for the discharge.**

Caution:	**While working on a complete defibrillator section assembled in the lower housing (e.g. to remove a board), do not wear an antistatic strap connected to the earth. While working on PCBs of the defibrillator section that are outside the device and disconnected from it, comply with applicable ESD rules.**

Warning:	**After working on the lower part, the energy values are to be tested systematically, followed by a general device test. The energy values shall be located with a tolerance of ± 15% or ± 4 Joules.**

6.3.1. Verification of the full discharging of the HV capacitor

Caution: The high-voltage capacitor (5) of MULTIPULSE BIOWAVE FRED® devices has two capacities – C1 (30 µF/3.6 kV) between terminals C and C1 and C2 (30 µF/1.2 kV) between terminals C and C2.

When the INSULATION AND SHIELDING circuit (24) is removed, the components of the defibrillator section become accessible. Place the lower part flat with the handle turned towards you. Connect a voltmeter with a high-voltage probe (or a high-voltage divider) at the terminals of the high-voltage capacitor. Connect the COM pole of the multimeter to the terminal marked (C) of the high-voltage capacitor and the high-voltage probe (or high-voltage divider) to the terminal (C1) of the high-voltage capacitor. Make sure that there is no load voltage at capacity C1. Repeat the operation for capacity C2 between (C) and (C2).

6.3.2. Removing the DEFIBRILLATOR CONTROL circuit

After removing the shielding cover (24), the DEFIBRILLATOR CONTROL PCB is entirely accessible. Place the lower part flat with the handle turned towards you. To remove the DEFIBRILLATOR CONTROL PCB (42) from the lower part, follow the instructions below:

1. The DEFIBRILLATOR CONTROL PCB is connected to the HIGH-VOLTAGE CIRCUIT through a board-to-board connector (J1).

2. Just pull up the DEFIBRILLATOR CONTROL circuit till it is completely separated from the board.

Caution:	**This circuit contains components sensitive to electrostatic discharge. After disconnecting the PCB from the device, follow applicable ESD rules.**

6.3.3. Removing the POWER SUPPLY circuit

After removing the shielding cover (24), the POWER SUPPLY PCB is entirely accessible. Place the lower part flat with the handle turned towards you. To remove the POWER SUPPLY PCB (16) from the lower part, follow the instructions below:

1. The POWER SUPPLY PCB is connected to the HIGH-VOLTAGE CIRCUIT through a board-to-board connector (CP14).

2. Just pull up the POWER SUPPLY circuit till it is completely separated from the board.

3. While removing the POWER SUPPLY circuit, take care not to damage the connector (J17) on the HIGH-VOLTAGE CIRCUIT located close by.

Caution:	**This circuit contains components sensitive to electrostatic discharge. After disconnecting the PCB from the device, follow applicable ESD rules.**

6.3.4. Removing the ECG PREAMP PROTECTION circuit

After removing the shielding cover (24), the ECG PREAMP PROTECTION circuit becomes fully accessible. Place the lower part flat with the handle turned towards you. To remove the ECG PREAMP PROTECTION circuit (25) from the lower part, follow the instructions below:

1. The ECG PREAMP PROTECTION PCB is connected two high-voltage wires (white and orange) to the connector for the large defibrillation electrodes.

2. To disconnect the two high-voltage wires, pull back the insulating sleeves and lugs with flat pliers, taking care not to crush the connector.

3. After the above steps have been completed, the ECG PREAMP PROTECTION board can be removed from the lower part.

Caution:	**This circuit contains components sensitive to electrostatic discharge. After disconnecting the PCB from the device, follow applicable ESD rules.**

While putting back the ECG PREAMP PROTECTION circuit, make sure that the Faston lugs connected to the two high-voltage wires (orange and white) are installed correctly. Incorrect installation of these lugs can lead to immediate malfunctioning of the defibrillator section or malfunctioning after some time (if the contacts are loose). Make sure that nothing has been forgotten before starting up the device.

Every time the board is replaced, remember to set the impedance (see defibrillation preamp board adjustment procedure).

6.3.5. Removing the HIGH-VOLTcircuit

Note: It is preferable to use additional marking for high-voltage cables.

After the shielding cover (24) and the two high-voltage wires (orange and white) are removed from the ECG PREAMP PROTECTION PCB (25) (see relevant procedures), the HIGH-VOLTAGE SWITCHING circuit can be removed. Place the lower part flat with the handle turned towards you. To remove the HIGH-VOLTAGE SWITCHING circuit (9) from the lower part, follow the instructions below:

1. Carefully remove the three high-voltage cables (lugs J6, J9 and J2) connected to the high-voltage capacitor. To remove these and the following cables, pull up the insulating sleeves and the lugs with flat pliers.

2. Carefully remove the two high-voltage wires (lugs J10 and J11) connected to the connector for the large defibrillation electrodes.

3. Carefully remove the high-voltage cable connected to lug J12 of the HIGH-VOLTAGE CIRCUIT.

4. Carefully remove the high-voltage cable connected to lug J4 of the HIGH-VOLTAGE CIRCUIT.

5. Also remove the two cables (red and black) connected to lugs J19 and J20 on the HIGH-VOLTAGE SWITCHING circuit.

6. Remove the cable from connector J18 of the HIGH-VOLTAGE SWITCHING circuit.

7. Remove the four high-voltage wires from the high-voltage converter that are connected to lugs J3 (red), J4 (black), J5 (white) and J7 (blue) of the HIGH-VOLTAGE SWITCHING circuit.

8. Unscrew the four screws used to fix the HIGH-VOLTAGE SWITCHING circuit and take them out.

9. After the above steps have been completed, the HIGH-VOLTAGE SWITCHING board can be removed from the lower part.

10. While replacing the HIGH-VOLTAGE SWITCHING circuit, also unsolder the (grey) wire soldered to tab J2 of the HIGH-VOLTAGE CIRCUIT.

While putting back the HIGH-VOLTAGE SWITCHING circuit, fix it with the two fixing screws and make sure that the high-voltage cables with Faston lugs are installed correctly. Incorrect installation of these lugs can lead to immediate malfunctioning of the defibrillator section or malfunctioning after some time (if the contacts are loose), or even the destruction of several circuits. Also make sure that the wires (black and red, J19 and J20 respectively) are connected and that the cable with AMP connector is connected to J18 of the HIGH-VOLTAGE SWITCHING circuit. Put back any cable clamps that may have been removed while disassembling the HIGH-VOLTAGE SWITCHING circuit. Make sure that nothing has been forgotten before starting up the device.

Caution:	**This operation concerns a critical subassembly of the defibrillator section, which carries high voltages. It may only be performed by personnel who have special authorisation and training to work on MULTIPULSE BIOWAVE FRED devices.**

Caution:	**While working on high-voltage wires, take care not to damage the cables.**

6.3.6. Removing the HIGH-VOLTAGE CIRCUIT

After removing the shielding cover (24), the DEFIBRILLATOR CONTROL PCB (43) and the POWER SUPPLY circuit (1) (see relevant sections), the HIGH-VOLTAGE CIRCUIT is accessible. Place the lower part flat with the handle turned towards you. Follow the instructions below to remove the HIGH-VOLTAGE CIRCUIT (43) from the lower part for repairs:

1. Carefully remove the cable with an Amp connector from base J17 of the HIGH-VOLTAGE CIRCUIT.
2. Carefully remove the high-voltage cable connected to lug J16 of the HIGH-VOLTAGE CIRCUIT. To remove the cable, pull up the insulating sleeve and the lug with flat pliers.
3. Carefully remove the red and black cables from lugs J7 and J8. Proceed as described.
4. Carefully remove the cable with an Amp connector from base J6 of the HIGH-VOLTAGE CIRCUIT.
5. Carefully remove the two high-voltage cables connected to lugs J4 and J12. Proceed as described.
6. Carefully remove the four high-voltage cables from the high-voltage converter connected by Faston lugs to lugs J2, J4, J5 and J7 of the HIGH-VOLTAGE SWITCHING circuit. Undo the corresponding cable clamps to remove the cables.
7. Unscrew the two fixing screws of the HIGH-VOLTAGE CIRCUIT located close to the insulating wall close to the high-voltage capacitor.
8. Also unscrew the three metal fixing pieces of the HIGH-VOLTAGE CIRCUIT, close to the rear wall.
9. Now lift the HIGH-VOLTAGE CIRCUIT vertically till the board-to-board connector formed by base J15 and male connector J1 of the battery interface PCB are fully disconnected.

10. Unsolder the grey wire from the HIGH-VOLTAGE SWITCHING circuit soldered to pin J2 on the rear of the PCB.

11. The HIGH-VOLTAGE CIRCUIT can now be removed from the lower part.

Caution:	**This circuit contains components sensitive to electrostatic discharge. After disconnecting the PCB from the device, follow applicable ESD rules.**

Working on the HIGH-VOLTAGE CIRCUIT is a delicate operation, which concerns a key component for the correct operating of the entire device. All work on this circuit shall be performed with utmost care in order not to damage any component.
While putting in place the HIGH-VOLTAGE CIRCUIT, take care to ensure that the high-voltage cables with Faston lugs are put in place correctly. Incorrect installation of these lugs can lead to immediate malfunctioning of the defibrillator section or the entire device or malfunctioning after some time (if the contacts are loose). Make sure that no cable is stuck anywhere and that the cables are connected to the right location. Also make sure that the various board-to-board connections are made correctly; Put back the various cable clamps so as to restore the original wiring. Do not forget to solder the grey wire to pin J2 of the HIGH-VOLTAGE CIRCUIT. While putting in place the fixing piece located nearby, make sure that it is not in contact with pin J2. Make sure that nothing has been forgotten before starting up the device.

Caution:	**This operation concerns a key component of the device. Failure to put the HIGH-VOLTAGE CIRCUIT in place correctly could damage the device beyond repair. This operation may only be performed by personnel who have special authorisation and training to work on MULTIPULSE BIOWAVE FRED devices.**

6.3.7. Replacing the HV Capacitor

Warning:	**This operation concerns the high-voltage capacitor, which can be charged to a fatal voltage. Before starting to work, make sure that the high-voltage capacitor is fully discharged (see relevant section). Never touch the terminals of the HIGH-VOLTAGE CIRCUIT directly. The high-voltage capacitor may only be replaced by specially authorised and trained personnel.**

6. REPLACEMENT OF PARTS

Caution: **The high-voltage capacitor (5) of MULTIPULSE BIOWAVE FRED® devices has two capacities – C1 (30 µF/3.6 kV) between terminals C and C1 and C2 (30 µF/1.2 kV) between terminals C and C2.**

The replacement of the high-voltage capacitor is required extremely rarely, as the capacitor has a very long life. However, if needed, the high-voltage capacitor can be replaced after removing the shielding cover (24). Place the lower part flat with the handle turned towards you. To remove the high-voltage capacitor (5) from the lower part, follow the instructions below:

1. First clear the insulating piece of the high-voltage capacitor (22) by making an incision along the silicone fixing seal between the insulating piece of the high-voltage capacitor (5) and the outer wall of the lower frame. Make the incision with a Stanley knife, taking care to prevent accidental injury.

2. When the silicone seal has been cut fully, remove the insulating piece from the high-voltage capacitor.

3. Repeat the operation with the other silicone seal located between the insulating wall of the lower housing and the high-voltage capacitor itself.

4. When the silicone seal has been cut fully, the high-voltage capacitor must be free in the housing.

5. Remove lug J16 of the HIGH-VOLTAGE CIRCUIT, with the black wire connected to the high-voltage capacitor housing.

6. Remove the three high-voltage cables connected to the high-voltage capacitor. To do so, cut the various cable clamps and carefully remove the three high-voltage cables connected to lugs J2, J6 and J9 of the HIGH-VOLTAGE SWITCHING circuit. To remove the cables, pull up the insulating sleeve and the lug with flat pliers.

7. After the above steps have been completed, the high-voltage capacitor can be removed from the lower part.

After removing the (fully discharged) high-voltage capacitor from the lower part, short its three terminals with a conducting wire.

While replacing the high-voltage capacitor, wire it before fixing it into its housing. Connect the pole marked (C) of the high-voltage capacitor to lug J6 of the HIGH-VOLTAGE SWITCHING circuit, pole (C1) to lug J2 of the HIGH-VOLTAGE SWITCHING circuit and pole (C2) to lug J9 of the HIGH-VOLTAGE SWITCHING circuit. Take care to follow the above polarity instructions and check if the Faston lugs are placed correctly. Incorrect installation of these lugs can lead to immediate malfunctioning of the defibrillator section or malfunctioning after some time (if the contacts are loose). Position the high-voltage capacitor in its slot and glue the high-voltage capacitor housing against the insulating wall of the lower frame with silicone. Put in place a new high-voltage capacitor insulating piece (22) and glue it with silicone. Put back the cable clamps as they were before the operation. Make sure that nothing has been forgotten before starting up the device.

Caution:	**This operation concerns a key component of the high-voltage section. It may only be performed by personnel who have special authorisation and training to work on MULTIPULSE BIOWAVE FRED devices.** **All operations shall be followed by a test of the delivered energy values.**

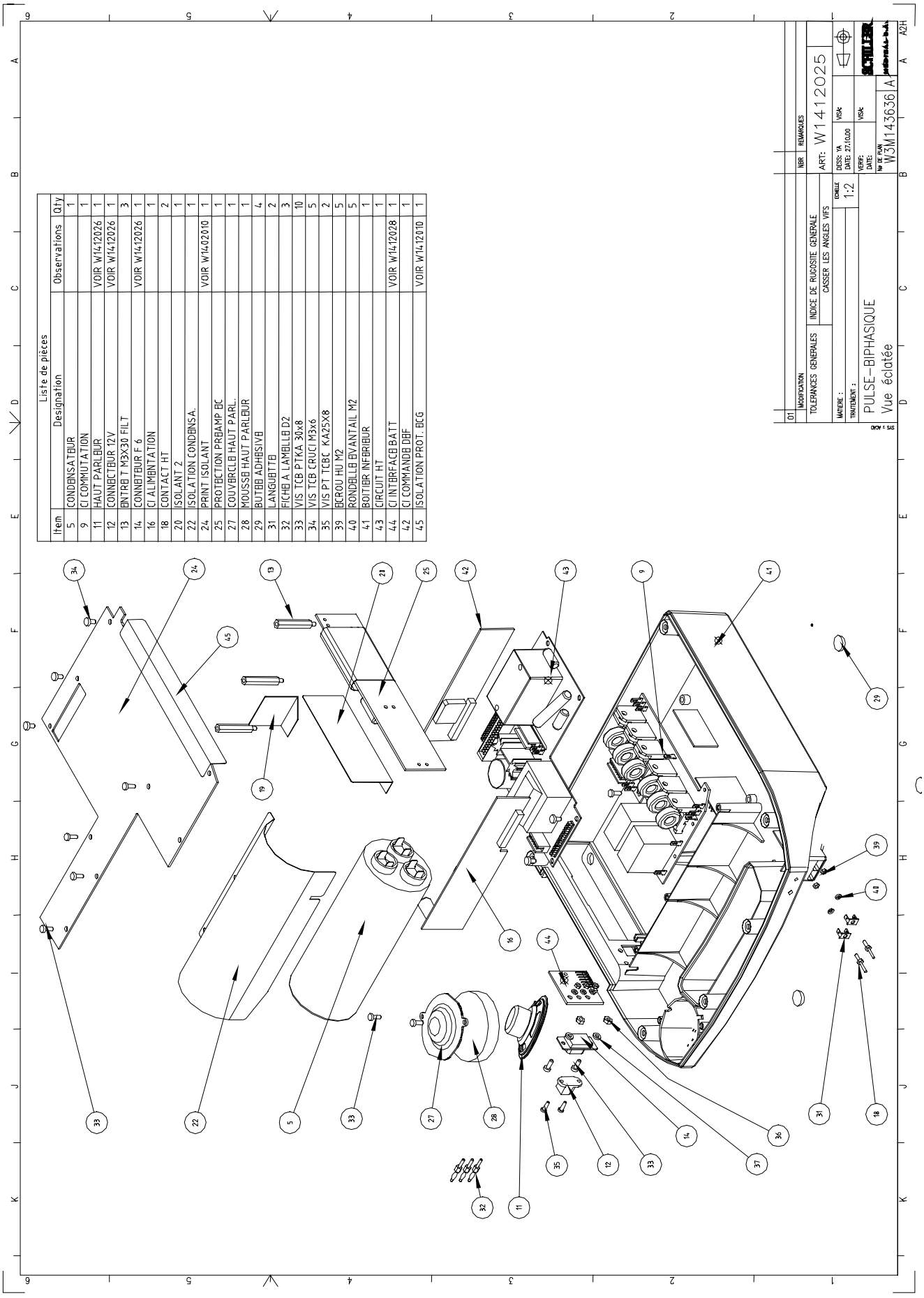
6.3.8. Replacement of parts

Warning:	**Parts may only be replaced by personnel who have been specially trained and authorised by Schiller Medical.** **Also, only original Schiller Medical replacement parts may be used.**

Note:	While ordering parts from Schiller Medical, provide the article number of the device and the serial number stated on the bottom of the device. Specify also the article number of the part, the reference, the description in the list of parts and the ECL of the replaced part.

6. REPLACEMENT OF PARTS

6. REPLACEMENT OF PARTS



Liste de pièces

Item	Designation	Observations	Qty
5	CONDENSATEUR		1
9	CI COMMUTATION		1
11	HAUT PARLEUR	VOIR W1412026	1
12	CONNECTEUR 12V	VOIR W1412026	1
13	ENTRE T M3X30 FILT		3
14	CONNECTEUR F 6	VOIR W1412026	1
16	CI ALIMENTATION		1
18	CONTACT HT		2
20	ISOLANT 2		1
22	ISOLATION CONDENSA.		1
24	PRINT ISOLANT	VOIR W1402010	1
25	PROTECTION PREAMP BC		1
27	COUVERCLE HAUT PARL.		1
28	MOUSSE HAUT PARLEUR		1
29	BUTEE ADHESIVE		4
31	LANGUETTE		2
32	FICHE A LAMELLE D2		3
33	VIS TCE PTKA 30x8		10
34	VIS TCE CRUCI M3x6		5
35	VIS PT TCEC KA25X8		2
39	ECROU HU M2		5
40	RONDELLE BVANTAIL M2		5
41	BOITIER INFERIEUR		1
43	CIRCUIT HT		1
44	CI INTERFACE BATT	VOIR W1412028	1
42	CI COMMANDE DBF		1
45	ISOLATION PROT. ECG	VOIR W1412010	1

01	MODIFICATION	NBR	REMARQUES

TOLERANCES GENERALES — INDICE DE RUGOSITE GENERALE — CASSER LES ANGLES VIFS

ART: W1412025

DESS: YA DATE: 27/10/00 — VISA:

VERIF: DATE: — VISA:

ECHELLE 1:2

MATIERE :

TRAITEMENT :

PULSE-BIPHASIQUE

Vue éclatée

N° DE PLAN W3M1436361 A

A2H

6. REPLACEMENT OF PARTS

7. OPERATING EXPLANATIONS

7.1. GENERAL OPERATION

From the technical standpoint, **MULTIPULSE BIOWAVE FRED®** is divided into two subassemblies:

- The upper part of the device encloses the following:
  . ECG signal acquisition from adhesive defibrillation electrodes or from the patient cable,
  . ECG signal analysis,
  . ECG signal display,
  . Display of messages in the AED mode
  . Voice prompt system
  . Saving of the ECG and events on the PCMCIA memory card,
  . Optional sound environment recording module
  . Optional SpO2 module

- The lower part of the device encloses the following:
  . PCB power supply
  . Pulse biphasic waveform defibrillator section
  . ECG preamp protection
  . Cadmium-nickel battery charging

The upper part includes the following components:

- twelve-lead ECG amplifier for acquiring signals from the patient cable and the interface with the CPU
- ECG preamplifier for acquiring signals from the adhesive electrodes
- CPU for managing the communication between the various functional parts
- VF detection circuit
- LCD monitor for viewing traces and messages
- Backlight converter for the LCD monitor
- Circuit for saving the ECG and events on the PCMCIA card
- Control keypads

It may also include the following optional features:

- SpO2 circuit
- Circuit for saving the sound environment in the AED mode on the PCMCIA card (10 MB)

The lower part includes the following components:

- Control circuit for charging and discharging the high-voltage capacitor
- High-voltage capacitor charging circuit
- High-voltage capacitor
- High-voltage switching circuit to deliver the pulsed waveform
- ECG preamp protection circuit
- Power supply circuit that generates the power supply voltages from the battery.

7.2. UPPER PART

The section below describes the functioning of the various PCBs located in the upper part of the **MULTIPULSE BIOWAVE FRED**® device.
The PCBs are as follows:

- TWELVE-LEAD ECG AMP printed circuit board
- DEFIBRILLATION ECG PREAMP printed circuit board
- CPU printed circuit board
- BACKLIGHT CONVERTER support board

7.2.1. TWELVE-LEAD ECG AMPprinted circuit board

The TWELVE-LEAD ECG AMP printed circuit board (U3P287) is responsible for acquiring the ECG signal through the patient cable. The PCB also takes charge of transmitting ECG data to the CPU.

The PCB is made up of the following:

- ECG input circuits
- ECG signal amplification,
- Pacing and artefact recognition
- Microcontroller
- Non-floating part
- Power supply
- Data transmission.

OVERVIEW

The TWELVE-LEAD ECG AMP PCB is made up of an eight-channel hardware amplification chain, a microcontroller for acquiring and processing ECG data, a section for transmission between the floating and the non-floating parts and a power supply.
The hardware amplification chains are those of leads I, II and V1 to V6. Leads III and AVR, AVL and AVF are calculated by the microcontroller. The data from all twelve leads are transmitted by a serial bi-directional link to the non-floating part for processing by the HOST CPU.

ECG INPUT STAGES

The input stages of the TWELVE-LEAD ECG AMP board include components that offer protection from defibrillation shocks and high-frequency surgical instruments.
Protection from defibrillation shocks is provided by resistors R1 to R19 and sparkers E1 to E9. Along with the resistors above, capacitors C1 to C9 form a low-pass filter in order to attenuate the high-frequency components of signals if electrosurgery is used. Poor electrode contact is recognised by polarising the ECG inputs with a voltage source via high resistances. If the electrode contact is loose, the DC component of the ECG signal increases, as does the output voltage of following stages IC10 to IC12. The signals are converted by the ADC via multiplexers IC4 and IC5. A 10-Hz signal may also be injected at each input through input multiplexers in order to check the proper functioning of the amplification chain.

7. OPERATING EXPLANATIONS

ECG AMPLIFICATION CHAIN

The paragraph below describes the ECG channel corresponding to lead I (the structure of other channels is identical). Along with IC100, following stages IC10A and IC10B form an instrumentation amplifier with a gain value of 5. The following amplification stage (IC102A) eliminates the DC component of the signal through C110. The lower cut-off frequency of that stage can be modified by analogue multiplexer IC110A. The upper cut-off frequency is determined by capacitors C111 and C112. Stages IC110A, IC110B and C111 form a sample-and-hold device in order to reduce the baseline offset in the case of high-amplitude pulses, e.g. with a pacemaker. The function is active when the two analogue multiplexers have a high impedance. The last amplification stage (IC102B) is identical to the previous stage, but does not include a sample-and-hold function. The total amplification of the chain is 200. The lower cut-off frequency (second order) can be switched from 0.05 Hz to 0.5 Hz, whilst the upper cut-off frequency (fifth order) is fixed and is equal to 150 Hz.

PACING AND ARTEFACT DETECTION

Pacing pulses and artefacts are recognised by the fact that they have a greater component of higher frequencies. For that purpose, each ECG channel may be selected by the microcontroller via multiplexer IC301. The first amplification stage is made up of IC302A. The higher frequency components of the signal are eliminated by C310 and R310. Components R311, C311 and R313, C311 limit the upper bandwidth. The following stage is built identically (IC302). The two stages make up a band-pass filter that detects and amplifies signal disturbances. Circuits IC302C and IC302D include a window comparator. When the signal disturbance amplitude exceeds a given limit, the comparators set off two monostable components IC303A and IC303B. They control the sample-and-hold stages and supply a signal to the microcontroller. The microcontroller determines if the pulse is an artefact or a pacemaker pulse and can also affect the sample-and-hold stage.

MICROCONTROLLER

The digital part of the TWELVE-LEAD ECG AMP board includes a microcontroller (IC900), an address flip-flop (IC903), memory modules (IC901, IC902), address decoding circuits (IC908, IC909), port extension circuits (IC905 to IC907), a reset circuit with power supply voltage monitoring (IC930) and a twelve-bit analogue-digital converter (IC920).

The microcontroller is responsible for the following functions:

- Mains frequency rejection
- Pacing detection source selection
- Pacing recognition and suppression
- QRS complex detection
- Miscellaneous filtering functions
- Communication with the HOST CPU
- Self test of the analogue part

Because these functions are performed by the software, their characteristics are guaranteed over time. The microcontroller can change the lower cut-off frequency of each channel from 0.05 Hz to 0.5 Hz through the “back_x” signal. The function enables the trace to return rapidly in the case of an overrun due to channel saturation. The block signal acts as a sample-and-hold device if pacing or an artefact is recognised.
By injecting a 10-Hz signal via multiplexers IC1 to IC3, the microcontroller also runs a self test of the hardware channels. The resulting signal is processed by the microcontroller and the test result is sent to the HOST CPU. Any electrode fault is determined by means of multiplexers IC4 and IC5.

NON-FLOATING PART

POWER SUPPLY

The TWELVE-LEAD ECG AMP circuit is powered by a push-pull circuit associated with controller IC700 and switching transistors T700 and T701. The converter secondary supplies two floating power supply voltages: +5V and –5V. Voltage control is applied on the +5V output of the secondary by means of circuit IC701 and optocoupler OPT700. Regulation relies on the principle of pulse width modulation.

DATA TRANSMISSION

Communication with the HOST CPU takes place through a 115.2 KB bi-directional serial channel. All data transmissions on this PCB operate according to the same principle, so the description is provided for only one channel. The data are applied at optocoupler OPT600 through MOSFET T600. The current limitation of the optocoupler emitting diode is performed by R600. When the current passes through the diode, there is a drop in the voltage at the terminals of R603 on the reception side. As a result, the voltage at the terminals of R603 reflects the flow of information. The signal is differentiated through R604 and C600 before being applied to a Schmidt trigger (IC911A). The output of the Schmidt trigger is connected to the serial port of the microcontroller. The signal amplitude (p2 of IC911A) ought to be greater than twice the hysteresis at p3. The transmission chain for the QRS signal is very similar to the circuit described above. This information is transmitted at a slightly slower speed, with greater hysteresis (1.5 times).

7.2.2. DEFIBRILLATION ECG PREAMPprinted circuit board

The defibrillation ECG printed circuit board (W4P14 1691) is responsible for acquiring the ECG signal taken through the adhesive defibrillation electrodes. This circuit transmits the ECG signal to the floating part of the patient cable ECG preamplifier.

The PCB is made up of the following:

- Floating power supply
- Communication
- PWM modulation
- PWM demodulation
- Amplification and processing
- Pacing inhibition
- Amplification chain verification

OVERVIEW

The defibrillator ECG preamplifier is responsible for amplifying and filtering the ECG signals and the contact impedance measurement signal. It is made up of two floating areas. The floating area that is in contact with the patient contains preamplifier U5 and U4, filter R27, R28, C16, R26 and C18, PWM modulator U3 and U8B of the ECG signal and amplifier U2 and U15, filtering C6, R7, C7, R8, C9, R13, C53 and R41 and PWM modulator U3 and U8A of the signal from the contact impedance measurement. The other floating area that is connected to the 12-channel preamplifier contains PWM demodulator U16 and power supplies U9 and U10.
Transformer TR1 and optocouplers U11, U12, U13 and U14 are responsible for insulating, supplying power to and ensuring communication between the two floating areas.

7. OPERATING EXPLANATIONS

POWER SUPPLY

The power supply of the defibrillator floating part is built around transformer TR1. Oscillator U9 generates a square signal with a cyclical ratio of 1. It is applied through driver U10 to the primary of transformer TR1. The defi_on/off signal is used to switch the power on and off. The voltage at the secondary of TR1 is rectified by D4, D5, D6 and D7 and stabilised by regulators RG1 and RG2. The voltages obtained in this way +VFD and –VFD supply power to the defibrillator floating part.

COMMUNICATION

Communication between the defibrillator floating part and the patient cable floating part is provided through optocouplers U11, U12, U13 and U14. Communication takes place in the form of digital signals. The pulse width of analogue signals ECG_DEFI and IMP_ELEC_DEFI is modulated before they are applied at optocouplers U11 and U14. Control signals 10HZ_P and INH_PACE are applied directly to the optocouplers.

PWM MODULATION

PWM modulation is provided by a triangular signal generator built around U3. This reference signal is applied at the same time as the analogue signals to be modulated on the comparators, which supply pulse width modulated signals. These control the optocouplers.

PWM DEMODULATION

The signals delivered by optocouplers U11 and U14 are applied to the comparators with hysteresis through capacitive links. The modulated signals from the comparators are applied to low-pass filters U16, which return analogue signals.

AMPLIFICATION AND PROCESSING OF ANALOGUE SIGNALS

The composite signal from the patient contains two types of information. It includes the ECG signal and the (20 KHz) signal of the contact impedance measurement.

AMPLIFICATION AND FILTERING OF THE ECG SIGNAL

The ECG signal is taken from the composite signal with the filter made up of R102, R103 and C69. After that, it is amplified by the differential amplifier built around U5. A second amplification is provided with U4A. The amplified ECG signal from U4A is applied to modulator comparator U8B. At the same time, at the output of U4A, the ECG signal amplified through the electronic switch is filtered by the low-pass filter made up of R26 and C18 to retain only the DC component of the amplified ECG signal. This DC component of the polarisation voltage given to the ECG signal is brought to detection comparators U17 via U4B and R107. The output of the comparators is applied to transistor T4 which controls electronic switch U7C, which brings a voltage of ~3.5V to modulation comparator U8A.

AMPLIFICATION AND FILTERING OF THE IMPEDANCE MEASUREMENT SIGNAL

The signal taken from the patient is applied to follower U2 and filtered by high-pass filters C6, R7 and C7, R8 and C9, R13 and C53, R41 in order to eliminate the DC component and the 50 Hz noise. It is then amplified by U2C and U2D. The amplified filtered 20 KHz impedance measurement signal is rectified by U15A and D1 and brought to U15B, which has a P1 adjustment input to adjust the detection limit of the contact impedance. The signal from U15B is applied to the modulator.

PACING INHIBITION

When a pacing pulse is detected, signal INH_PACE opens a link that monitors the DC component of the ECG signal in order to avoid any drift in the signal as a result of the pacing pulses.

AMPLIFICATION CHAIN VERIFICATION

The 10Hz_P signal is analysed to verify the validity of the chain of amplification. The 10Hz_P signal, with an amplitude located between +VFD and –VFD, is brought to a voltage compatible with the input of differential amplifier U5 through U6. At the same time, the pulses of 10Hz_P charge capacitor C20 which makes electronic switches U7 conduct and makes it possible to inject the 10Hz_P signal in the differential stage of the amplification chain.

7.2.3. CPU printed circuit board

The CPU PCB (W4P141694) makes up the central processing unit of the device and is built around several microcontrollers 80C251. Each microcontroller performs specific tasks.

The PCB is made up of the following:
- HOST CPU
- Video CPU
- Recording CPU
- VF CPU
- Optional SpO2 module

OVERVIEW

The CPU PCB is built around a structure of four microcontrollers 80C251, which operate in the master-slave mode. The master microcontroller function is performed by the HOST microcontroller (U1). The slave microcontroller function is performed by microcontrollers Display (U100), Recording (U50) and VF (U70).
Communication between the HOST microcontroller and the Recording and VF microcontrollers takes place through a serial link via UART (U25).
Communication between the HOST microcontroller and the Display microcontroller takes place through a parallel link (D[0-7]) via flip-flop D (U103).
Communication with the SpO2 module, external module and PCMCIA modem takes place through a serial link, via UARTs (U25, U26).
Communication between the CPU and defibrillation takes place through input and output flip-flops.

HOST CPU

The HOST CPU is built around a HOST microcontroller (U1), an EPROM (U3), a working RAM (U4), a decoder (U6), input flip-flops (U20, U39, U40, U41) output flip-flops (U103, U18, U33, U34, U35, U36), serial communication UARTs (U25, U26), the device on/off system (D1, D3, D4, T3 etc.),the time stamper (U5), the battery voltage monitoring system (R35, R36, U38, U37), the configuration EEPROM (U7), the analogue-digital converter (U8), the ECG signal amplification-filtering system (U10), the LCD contrast adjustment (U9A), the reset and watchdog circuit (U17), the multiplexer and analogue-digital converter (U38, U37), the audio alarm generator with audio amplifiers (U43, U29, U30).

7. OPERATING EXPLANATIONS

OUTPUT FLIP-FLOPS

Reset

Control signals (RAZVID, RAZVF, RAZENREG, RAZSPO2, RAZUART1, RAZUART2) are associations through the OR gate, the signal (Reset) and resetting pulses generated by the HOST microcontroller through output flip-flop U18.

Audio alarms

The control signals (U33[14-19]) generated by output flip-flop U33 are used to control the form and tone of audio alarms.

Spoken messages or audio alarms

Control signals (AUDIO [0-2]) generated by output flip-flop U34 control the type of audio emission.

Communication with the defibrillator

The defibrillator is managed by defibrillator control signals (-SYNCDEF, STARTCONV, SACHARGE, SAWSEL[0-3] and WDUMP) generated by output flip-flops U36 and U35. The signals have been described in detail in the defibrillator part.

Signal (-RSTSHOCK) generated by output flip-flop U33 is used to refresh the interrupt flip-flop used to control A/D power conversion of the current delivered during defibrillation shocks.

LCD backlight

Signal (BACKLIGHT) generated by output flip-flop U35 is used to control the on/off function of the backlighting.

Luminous indicator of the defibrillator input

Signal (-PATCHLED) generated by output flip-flop U35 is used to control the luminous indicator located above the defibrillator input.

Luminous indicators of the analyse key

The luminous indicators of the analyse key are controlled by line control signals (LED[1-3]RED, LED[1-3]GREEN) generated by output flip-flop U35.

ECG preamplifier power supply

The ECG preamplifier power supply is controlled by signal (-ECG_ON) generated by output flip-flop U35.

Communication with the CPU

Communication between the HOST CPU and the Display CPU is managed by an interrupt flip-flop that is refreshed by signal (-RSTRDYV) generated by output flip-flop U33.

Multiplexing and analogue-digital conversion

The channel of the signals to be converted is selected by signals (ADMUX[0-2]) generated by output flip-flop U34.

INPUT FLIP-FLOPS

Keypad keys

The activation of keypad keys via the low-pass filters and the polarisation resistors built around RN1, C80-C87 and RN2 is applied by input flip-flop U40 and read by the HOST microcontroller.

Setting jumpers

Setting jumpers CH2-CH9 and CH10-CH11 used for setting up the device are taken into account by input flip-flops U20 and U41.

Communication with the defibrillator

The defibrillator status signals (DEFCHARGE, DEFREADY, SECDISCH, -DEFSEC and –CDNI/LI) are applied by input flip-flop U39. The signals have been described in detail in the defibrillator part.

Cold start

Signal CLDSTRT generated by the voltage supervisor/watchdog circuit is applied by input flip-flop U41. It informs the HOST microcontroller of the reason for the generation of a reset pulse.

7. OPERATING EXPLANATIONS

Communication with the display CPU

Display CPU status signals (READY_VID and ERRORVID) are applied by input flip-flop U41. READY_VID is used to synchronise the transfer of data between the HOST CPU and the display CPU and ERRORVID is a signal that monitors the functioning of the display CPU. Besides, signal (READY_VID), which is taken into account by input flip-flop U39 in association with signal (-INTVIDEO), is used to ensure real-time communication between the two CPUs.

Voice prompt control

Status signal (V_IN_PROGR) from the VF CPU is applied by input flip-flop U39. It is used to prevent conflicts between the transmission of spoken messages and audio alarms.

SERIAL COMMUNICATION

Communication between the HOST CPU and the VF CPU, the recording CPU, the SpO2 module, the ECG preamplifier, the PCMCIA modem and the external modem takes place through a serial link via U25 and U26. Communication with the external modem alone supports a full RS 232 link.

The two quadruple UARTs are controlled by the HOST microcontroller via buses D[0-7] and A[0-2], control signals –PSEN, -WR, reset signals RAZUART[1-2], the selection signals of the various UARTs –CS and interrupt signal –INTUART. The signal occupies an interrupt input on the HOST microcontroller.

ON/OFF SYSTEM

The device can be switched on in three different ways:

1. Manually with the On/Off key
2. Automatically for the daily test (see the time stamper section below)
3. Switching on by inserting the battery (see the time stamper section below)

Pressing the On/Off keypad key forces line ONBYKEY to the low status. The signal becomes –ON/OFF through D1 and U18. It is applied to the power supply switching transistor located on the power supply PCB. At the same time, the ONBYKEY signal is applied through D4 and R12 to input 2 of the HOST microcontroller. In response, the microcontroller puts line KEEPWR of the output flip-flip in the high status. The signal is applied through R9, D3 at the base of T3, which is saturated and keeps the –ON/OFF signal in the low status. Pressing the On/Off keypad key once again forces line ONBYKEY to the low status. That low status is applied to input 2 of the HOST microcontroller, which in turn positions line KEEPWR on the low status. The amplitude of the –ON/OFF signal switches back to +Ubatt voltage and the power supplies are cut off.

Switching on with the On/Off button is disabled when the battery voltage is too low (9.5V). When the battery voltage is too low, output 7 of U117 switches to high. The signal is applied to comparator U118, which prevents signal-ON/OFF from switching to zero if the On/Off key is pressed, if the battery is inserted and if the device is trying to run a daily test.

Note:

When you press the On/Off button with a very low battery, the device switches on normally, but the backlighting does not go on. The device will operate as long as the On/Off key is kept pressed in.

TIME STAMPER

Time stamper U5 is under the control of the HOST microcontroller through bus D[0-7] and control signals ALE, -CSRTC, -PSEN, -WR.

In addition to its conventional function, the time stamper is required to fulfil two specific functions – automatic switching on for the daily test and switching on when the battery is inserted.

Automatic switching on for the daily test:
When output U5(1) switches to zero, that affects conductor T2, which saturates transistor T3 via D2 and R7, thereby taking the –ON/OFF signal to the ground. The –ON/FF signal controls the power supply switching transistor on the power supply PCB. At the same time, collector signal T3 is transmitted via D1, D4, R12 to HOST microcontroller U1 (12). In its turn, the HOST microcontroller sets signal (KEEPWR) to high. Through R9 and D3, the signal keeps T3 saturated.
Switching on when the battery is inserted:
When the battery is inserted in its slot, a pulse is generated at the terminals of the differentiator made up by R2 and C27. The pulse is transmitted by the time stamper through T1. In response, output 1 of the time stamper switches to low, which sets off the device switch-on sequence described above.
A lithium cell BAT1 is used to save the content of registries and provide buffer power supply for automatically switching on the device for the daily test, through jumper CH1.

BATTERY VOLTAGE MONITORING

Battery voltage monitoring is performed by dividing bridge R35 and R36. The signal collected (CHECKBAT) is sent to analogue-digital converter U37 via multiplexer U38.

SETTINGS EEPROM

EEPROM U7 saves some settings and adjustments. It is under the direct control of microcontroller U1 through a serial link made up of control signals CSEEPROM, CLKEEPROM and data signals SERIEL_IN, SERIEL_OUT.

DIGITAL-ANALOGUE CONVERSION AND AMPLIFICATION-FILTERING OF ECG SIGNAL

Digital-analogue converter U8 shares the serial link and control signals with the settings EEPROM. The analogue signal delivered by the converter first goes through offset-compensated follower U10A followed by 25 Hz filter R23 and C17 and final amplifier U10B with a gain of 1000.

LCD CONTRAST SETTING

Contrast setting uses the same digital-analogue converter as the settings EEPROM. The signal at the converter output is amplified by U9A and applied to the LCD.

RESET AND WATCHDOG

The + 5 V voltage supervision and watchdog functions are performed by U17. When the device is operating, the pulses from –CSWDOG constantly refresh the watchdog. When refresh pulses are interrupted, a reset pulse is generated and signal CLDSTRT switches to low. When a reset pulse is set off by the voltage supervisor, the CLDSTRT signal stays high.
Signal CLDSTRT is in relation with the HOST microcontroller through input flip-flop U41.

MULTIPLEXING AND ANALOGUE-DIGITAL CONVERSION

Analogue signals HVMONIT and IPAT from the defibrillator and signal CHECKBAT from the battery voltage monitoring system are applied to analogue-digital converter U37 through multiplexer U38. Signals ADMUX[0-2] of output flip-flop U34 control the selection of multiplexer channels. The analogue-digital converter is controlled by the HOST microcontroller via bus D[0-7] and control signals –CSADC, -PSEN, -WR.

AUDIO ALARM AND SOUND AMPLIFICATION

Audio alarms are generated by microcontroller U43 (PIC16IC54), which is under the control of the HOST microcontroller through output flip-flop U33. The audio alarm signal and the voice prompt signal (VOICE) are applied via multiplexer U31 to audio amplifiers U29 and U30.

VIDEO CPU

The video CPU is built around the video microcontroller (U100), its EEPROM (U102), output flip-flop (U105) and input flip-flop (U103). The data sent by the HOST microcontroller are received by the video microcontroller through input flip-flop U103. That communication is under the control of signals BUSY_VID and READY_VID. Signal ERRORVID of output flip-flop U105 informs the HOST microcontroller of the status of the video microcontroller. The associated optical link (U104) and status signal TM910OK are not effective.

RECORDING CPU

The recording CPU is built around the recording microcontroller (U50), its EEPROM (U52), its working RAM (U58), address decoder (U59), output flip-flops (U53, U54, U55 and U56) and the audio message control logic (U62, U61, U60) and the PCMCIA connector support.

OUTPUT FLIP-FLOPS

Outputs of flip-flops U53, U54, U55 and U56 are used to form the addresses of the flash memory. For making up the flash memory addresses, these flip-flops are addressed one after the other through bus DM[0-7] and CS… signals generated by decoder U59.

RECORDING CONTROL LOGIC

The audio signals picked up through a microphone (PHONE_IN and PHONEGND) are amplified, filtered and codified by U62. The counter built around U61 and gates U63 and U64 generate the conversion and sampling frequency of ADPCM encoder (U62) and regulates the transfer of data from the encoder to offset register U60. The data output from the offset register are read by the recording microcontroller and saved in the flash memory. The PCMCIA connector support that is screwed onto the CPU PCB receives the flash memory.

VF CPU

The VF CPU is built around the VF microcontroller (U70), its EEPROM (U72), its working RAM (U80), decoder (U79), voice prompt controller (U73 and U75) and analogue processing system (U90, U91, U92, U93, U94, U95 etc.), which includes A/D and D/A conversion (U78 and U77).

VOICE PROMPT CONTROLLER

Spoken messages are emitted by the voice prompt controller (U73). It is under the control of the VF microcontroller through DVF[0-7] and signals –RD_VF, -WR_VF and –CSSYNTH. Flash memory U75 contains the various messages. The analogue output of the messages takes place with amplifiers U76B and U66B.

ANALOGUE PROCESSING

The DC component of signal ECGX1000 is cancelled by capacitor C170. After that, the residual signal is filtered (U91) and rectified (U92). Resulting signal ECGMAX/2 is sent to the ADC. The signal associated with U96 provides automatic gain for the ECGFV signal. The amplitude of the ECGMAX/2 signal, associated with U66A, U93C and U93D, fixes the minimum authorised limit (LIMIT) for an analysis. Signal –DEPASS fixes the maximum authorised limit for an analysis. Signal ECGFV digitised by ADC (U78) is supplied in the analogue form ECGQRS by DAC (U77, U76A). This fixed-gain signal is used to recognise –QRSFV.

SPO2 MODULE

The SpO2 module is mechanically fixed to the CPU board. The floating power supply of the SpO2 module is provided by PWM controller U112, switching transistors T25 and T26 and transformer TR1.
The counter-reaction for voltage stability VSpO2 is provided through U115 and DZ10. Communication between the SpO2 module and the CPU takes place via optocouplers U113, U114 and U116.

7.2.4 BACKLIGHT CONVERTER support printed circuit PCB

The BACKLIGHT CONVERTER support printed circuit board (U3 P297) mechanically maintains the LCD monitor backlight circuit.

The function includes the following parts:
- BACKLIGHT CONVERTER support PCB
- backlight converter

The backlight converter is powered by the + 12 V voltage generated by the power supply PCB and supplies an output voltage of about 1 kV in order to light the LCD screen by means of a CFL tube included in the display.

7.3. LOWER PART

The section below describes the functioning of the various PCBs located in the lower part of the **MULTIPULSE BIOWAVE FRED®** device.
The PCBs are as follows:

- BATTERY INTERFACE printed circuit board
- POWER SUPPLY printed circuit board
- HIGH-VOLTAGE CIRCUIT printed circuit board
- DEFIBRILLATOR CONTROL printed circuit board
- HIGH-VOLTAGE SWITCHING circuit board
- ECG PREAMP PROTECTION printed circuit board
- INSULATION AND SHIELDING printed circuit board

7.3.1. BATTERY INTERFACE printed circuit board

The BATTERY INTERFACE PCB (W4P14 1682) is responsible for the mechanical and electrical connection between the contacts of the battery inserted in its slot and the electrical circuits of **MULTIPULSE BIOWAVE FRED®**.

The battery interface circuit includes three links via connector J1:

- power supply link: + UBATT
- earth link: GND
- cadmium-nickel battery or lithium cell recognition signal: NTC

7.3.2. POWER SUPPLY printed circuit board

The POWER SUPPLY PCB (U3 P296) generates all the power supply voltages required for the monitor section of FRED® to operate. The circuit also includes the On/Off transistor controlled by the CPU.
The input voltage of the power supply circuit must be located between 10 and 28 V.

The power supply printed circuit generates the following power supply voltages:

- + 5 V voltage that powers the logical circuits of the CPU board
- + 12 V voltage that powers the analogue circuits of the CPU board, the backlight converter and the radio amplifier.
- - 12 V voltage that powers the analogue circuits of the CPU board
- - 24 V voltage for adjusting the LCD monitor contrast

Transistor T100 takes care of the On/Off function through the ON/OFF control signal. The various power supply voltages are generated by two switching regulators (U800 and IC360), the input voltage of which is switched by transistor T100.

+ 5V VOLTAGE

The + 5 V power supply voltage is provided by switching regulator U800, switching transistors T800, T801, induction coil L800 and freewheel diode D801. The whole system makes up a step-down regulator with peak current limitation (R802 and R805).

+ 12 V VOLTAGE

The + 12 V power supply voltage is provided by switching regulator IC360, switching transistors T362 and T363, control transistors T360 and T361, transformer TR360 and rectifying diode D361. The system makes up a flyback mode regulator. The current is limited by the network made up of R360, R362 and R363. The voltage is controlled by dividing bridge R368, R369 and R370.

- 12 V VOLTAGE

The – 12 V power supply voltage is provided through another secondary coil of TR1. After it is rectified and filtered by D500 and C500, the secondary voltage is approximately – 15 V. Linear regulator IC500 regulates the voltage of the – 12 V output.

- 24 V VOLTAGE

The – 24 V power supply voltage is provided through a third secondary coil of TR1. After it is rectified and filtered by D600 and C600, the secondary voltage is approximately –- 28 V. Linear regulator IC600 and diode DZ601 regulate the voltage of the – 24 V output.

7.3.3. HIGH-VOLTAGE CIRCUIT printed circuit board

The HIGH-VOLTAGE CIRCUIT PCB (W4P14 1721) takes care of the electrical link between the various parts that make up the defibrillator. The POWER SUPPLY and DEFIBRILLATOR CONTROL PCBs are directly connected to the HIGH-VOLTAGE CIRCUIT. The HIGH-VOLTAGE SWITCHING PCB is connected to the HIGH-VOLTAGE PCB by means of three cables. The HIGH-VOLTAGE CIRCUIT is responsible for the transfer of energy between the battery and the high-voltage capacitor, and for battery charging, high-voltage capacitor charging voltage measurement, HIGH-VOLTAGE SWITCHING PCB control and patient relay activation.

The high-voltage circuit PCB (W14P14 1721) includes the various parts:

- Battery charge circuit via the external DC input
- Cadmium-nickel battery or lithium cell recognition circuit
- High-voltage generator
- High-voltage capacitor safety discharge
- Control signal forming circuit of the high-voltage switching PCB
- Patient relay activation circuit
- High-voltage capacitor charge voltage measurement circuit

The defibrillator function is a sequential circuit with four distinct phases:

1) Standby phase:	this is when the device is on (monitoring function) and the defibrillator part is standing by (no charging request).
2) Charging phase:	phase during which the high-voltage generator charges the high-voltage capacitor (30 µF / 3.6 kV and 30 µF / 1.2 kV).
3) Hold phase:	this phase lasts no more than 20 seconds, during which the charged high-voltage capacitor is ready to be discharged.
4) Discharging phase:	this is when the high-voltage capacitor is discharging.

7. OPERATING EXPLANATIONS

OVERVIEW

The high-voltage circuit associated with the high-voltage capacitor and the high-voltage switching circuit is the power unit of the defibrillator part. The high-voltage PCB has all the components required for charging the high-voltage capacitor and providing the control signals for the capacitor.
The high-voltage circuit control signals are generated on the defibrillator control PCB.
The power supply of the defibrillator part + UDEF (TP1) is supplied by the power supply board. The power supply is the battery voltage switched by the On/Off transistor of the power supply circuit. Using this power supply voltage, the defibrillator part generates its own source of +5V voltage through regulator RG2 (TP3).

STANDBY PHASE

During the standby phase, the whole high-voltage circuit (high-voltage generator included) is inactive. Only the high-voltage measuring circuits (U5B), some associated circuits (U3A) and the defibrillator control circuit are powered by the + 5 V voltage generated by RG2 (TP3). The drivers (U1, U2) of the control signals of the insulated gate bipolar transistors of the high-voltage switching circuit are powered by the + 12 V power supply voltage (TP2) generated on the power supply PCB.

CHARGING PHASE

The high-voltage converter (TR1), which is driven by the high-voltage generator (U4 and associated components) is responsible for the charging phase of the high-voltage capacitor. During the charging phase, safety discharge relay (RL1) is excited by transistor T3 controlled by signal STARTDEF (TP5) in order to enable the high-voltage capacitor to charge. Two conditions must be met to activate the high-voltage generator:

- Conditioning of the charging transistor (T10) by the presence of a low level at signal -CHARGEDR
- High level at signal GEST (TP6).

HOLD PHASE

When the high-voltage capacitor is charged to the selected energy value, the defibrillator switches to the hold phase, which lasts no more than 20 seconds. During the hold phase, transistor T11 is made to conduct by a low level at signal –DISCHENDR (TP9). The condition is required in order to validate possible defibrillation, during which the patient relay is activated by the two discharge transistors (T12 and T13).

DISCHARGING PHASE

The discharging phase is the phase during which the charged high-voltage capacitor is switched to the patient in order to defibrillate. The discharging phase consists in activating the patient relay and controlling the insulated gate bipolar transistors of the high-voltage switching circuit via drivers (U1, U2) in order to generate the pulse biphasic waveform. The discharging phase is always followed by a return to the normally closed position by the safety discharge relay (RL1), after a delay of 160 ms.
As a result, high-voltage capacitor discharging can be performed by two different circuits:

- Either by the external discharge circuit, i.e. via the high-voltage switching circuit and the patient relay (RL1 and RL2 on the circuit), for defibrillation.
- Or by the safety discharge circuit when relay RL1 of the high-voltage circuit is not excited and signal STARTDEF is on low. The safety discharge circuit is made up of the following components: RL1 and power resistor R1 of the high-voltage circuit.

Safety discharging of the high-voltage capacitor occurs when signal STARTDEF returns to the low level, in the following cases:

- If the energy level is changed to a value below the initial value
- When adhesive electrode disconnection is recognised
- If no defibrillation occurs after twenty seconds
- If a technical fault is found in the defibrillator part
- When the device is switched off

BATTERY CHARGE CIRCUIT

The battery charge circuit is made up of a source of DC current (RG1) associated with R13 and R14. Diode D11 protects the circuit if the external DC connection is reversed. In order to charge a cadmium-nickel battery inserted in the device, the input voltage must be at least 18V. In that case, the battery charging current is 125 mA.
If a lithium cell is used, the absence of NTC in the battery housing blocks transistor T5, which disables the battery charge current.

CADMIUM-NICKEL BATTERY OR LITHIUM CELL RECOGNITION CIRCUIT

The cadmium-nickel battery or lithium cell recognition circuit is made up of U3A, which recognises the presence of NTC in the battery slot. The detection is done by the NTC signal. Comparator U3A outputs the corresponding information for the CPU, signal –CDNI/LI.

HIGH-VOLTAGE GENERATOR

The high-voltage generator is used to charge the high-voltage capacitor to a preset energy level. The stored energy is measured by measuring the sum of the two charging voltages of the high-voltage capacitor (30 µF / 3.6 kV and 30 µF / 1.2 kV).
The high-voltage capacitor is charged by high-voltage converter (TR1), driven by PWM (U4) and associated components T1, T2, T6, T8 and T9. Two conditions must be met to activate the high-voltage generator:

- Activation of the charging transistor (T10) by a low level at signal -CHARGEDR
- High level at signal GEST (TP6).

When transistor T10 conducts, switching regulator U4 is powered, as is the primary of TR1. The presence of a high level at signal GEST unlocks the high-voltage generator, the oscillation of which generates the voltage required to charge the high-voltage capacitor (30 µF / 3.6 kV and 30 µF / 1.2 kV) through the two secondary coils of rectified TR1.
The high-voltage generator has a system for controlling the primary peak current formed by R2, R44 and C16 and a triggering circuit after the core formed by T6 and the associated components is demagnetised. The measurement circuit of the charging voltage at the primary of the high-voltage converter used to stop charging is made up of T4 (signal HVMES1). The high-voltage generator has two different charging speeds, depending on the type of power supply used (cadmium-nickel or lithium). Transistor T7 controls the two charging speeds defined by resistors R35, R38 and R30.

HIGH-VOLTAGE CAPACITOR SAFETY DISCHARGE CIRCUIT

The high-voltage circuit also includes the function for the safety discharge of the high-voltage capacitor. This function includes the safety discharge relay (RL1), which is used to discharge the high-voltage capacitor (30 µF / 3.6 kV and 30 µF / 1.2 kV) into resistor R1. The safety discharge relay is activated by transistor T3, which is driven by signal STARTDEF.

INSULATED GATE BIPOLAR TRANSISTOR CONTROL SIGNAL FORMING CIRCUIT

The high-voltage circuit includes two drivers (U2 and U3), which buffer the driving signals of the insulated gate bipolar transistor stages of the high-voltage switching circuit. The driver input signals are generated on the defibrillator control PCB. The driver output signals are connected to the high-voltage switching PCB through connector J6.

PATIENT RELAY ACTIVATION CIRCUIT

The patient relay activation circuit (RL1 and RL2 on the high-voltage switching circuit) is made up of transistors T11, T12 and T13. The transistors perform the following functions:

- T11 : discharge validation transistor driven by signal -DISCHENDR
- T12 : patient relay activation transistor driven by signal DISCH
- T13 : patient relay activation transistor driven by transistors T14 and T15, which are controlled by signals –SYNCDR and DISCHKEY2 respectively.

The patient relay is activated when the entire driving chain is active (simultaneous conduction by all the transistors). Transistors T14 and T15 also drive two pulsed discharge validation transistors through T12 and T15 on the high-voltage switching circuit.

HIGH-VOLTAGE CAPACITOR CHARGE VOLTAGE MEASUREMENT CIRCUIT

The circuit for measuring the sum of the charging voltages of the high-voltage capacitor (30 µF / 3.6 kV and 30 µF / 1.2 kV) is made up of two dividing bridges R47 / R9 and R48 / R41 referenced to the earth, and differential amplifier U5B. The network of diodes DN3 and DN4 forms a clipping network for protection from any transients during the high-voltage capacitor discharge. The output division factor (signal HVMES2) is 1100.

Any insulation fault in the IGBT discharge circuits (high-voltage switching circuit) is also monitored by U5B and the associated components. IGBT insulation faults are detected by resistors R69 and R70 wired on the high-voltage switching circuit. The detection function is performed by the CPU (upper part), which analyses signals HVEMS2.

7.3.4. DEFIBRILLATOR CONTROL printed circuit board

The DEFIBRILLATOR CONTROL PCB (W4P14 1722) generates all the control signals required for the defibrillator to operate. The PCB makes up the control stage of the power circuit made up of the HIGH-VOLTAGE CIRCUIT (W4P14 1721) and the HIGH-VOLTAGE SWITCHING circuit (W4P14 1724).

The PCB is made up of the following:

- Tension reference and energy selection multiplexer
- End-of-charging detection circuit
- Input interface circuits
- Reset circuit and microcontroller
- Output interface circuits
- Pulse biphasic waveform control circuit
- Safety switching and monitoring circuit

7. OPERATING EXPLANATIONS

OVERVIEW

The DEFIBRILLATOR CONTROL PCB (W4P14 1722) performs the following functions:

- monitoring the high-voltage capacitor charging process and the safety discharge function, through microcontroller (U12)
- generating the control signals required to drive the IGBTs that make up the pulse biphasic waveform
- hardware monitoring of some functions and disabling the defibrillator circuit if a technical fault is found.

STANDBY PHASE

During the standby phase, the entire defibrillator control circuit is supplied with + 5 V. Microcontroller (U12) timed by Q1 supplies a 16-ms WDCLK signal. Besides, two reference voltages are generated in the circuit: A + 4.00 V reference (DZ1) for selecting the energy values and a + 2.5 V reference (DZ2) for the safety chain comparators.

CHARGING PHASE

The high-voltage capacitor charging phase is initialised by signal SACHARGE from the CPU PCB (upper part) and interfaced by U10D. Following the control pulse, microcontroller (U12) supplies the following three signals: SECRST, STARTDEF and LOADC. These three signals reset the safety switch, excite the safety discharge relay and activate the high-voltage generator respectively. When the end-of-charging comparator (U3A) generates the –STOP signal, microcontroller (U12) interrupts the charging phase and switches to the hold phase.

HOLD PHASE

During the hold phase, the microcontroller (U12) supplies signal CFULL in order to make transistor T11 (high-voltage circuit) conduct, by a low level at signal –DISCHENDR. This condition is required to validate defibrillation through the patient relay and the IGBTs of the high-voltage switching circuit. The microcontroller limits the duration of the phase to 20 seconds maximum.
During the charging and hold phases, signal STARTDEF activates signals PREPULSE 1 and PREPULSE 2 through U6A, U6B and U6C in order to actively block the IGBTs of the high-voltage switching circuit. These pulses are generated after every
16 ms through U3B and associated components.

DISCHARGING PHASE

The discharging phase is triggered when the user presses the Shock key on the device. The Shock key supplies two signals, DISCHKEY1 and DISCHKEY2, which generate two control signals for microcontroller U12 through U9A and U9B. When the two signals DISCH and –DISCH2 change status, the microcontroller generates the DISCH and –DISCH signals. The DISCH signal drives transistor T12 (high-voltage circuit), which makes up the first patient relay activation channel (RL1, RL2 of the high-voltage switching circuit). In order to excite the patient relay, the second fully hard channel must also activate transistor T13 of the high-voltage circuit. When the two conditions are met, the patient relay is excited. During that time, signal –DISCH unlocks the 10 KHz oscillator (U7), counter (U5) and the EPROM (U4). After 25 ms, the signals at the EPROM output supply the control pulses of the IGBTs of the high-voltage switching circuit. The resulting 5 KHz switching by the IGBTs of the two phases of 4 ms each generates the pulse biphasic wave. Patient relay activation lasts 160 ms, after which time signal STARTDEF comes back to zero, which makes the contacts of the safety discharge relay return to the normally closed position.

7. OPERATING EXPLANATIONS

The IGBT stages of the high-voltage switching circuit are controlled by four signals, PREPULSE 1, PREPULSE 2, PHASE 1 and PHASE 2 generated by the defibrillator control circuit. Signals PREPULSE 1 and PREPULSE 2 block the IGBTs, while signals PHASE 1 and PHASE 2 make the IGBTs conduct.

VOLTAGE REFERENCE AND ENERGY SELECTION MULTIPLEXER

The reference voltage for the energy selection stage is made up of DZ1 (TL 1431C) and dividing bridge R68, R69. The fixed reference voltage is + 4.00 V. The energy selection circuit is made up of analogue multiplexer U1. This circuit is addressed by signals SAWSEL0 to SAWSEL3, which are generated by the CPU PCB (upper part). The voltage reference for a given energy value is formed by resistor R70 in association with a base resistance selected by the multiplexer. Stage U2A makes up a follower, the output of which supplies the reference voltage to the end-of-charging comparator (U3A).

END-OF-CHARGING DETECTION CIRCUIT

The end-of-charging detection circuit is made up of comparator U3A. The reference voltage corresponding to the selected energy is supplied by follower U2A. The measuring voltage (equal to the sum of the two charging voltages) is supplied by signal HVMES1 which is generated on the high-voltage circuit. When the amplitude of signal HVMES1 corresponding to the charging voltage of the high-voltage capacitor (30 µF / 3.6 kV and 30 µF / 1.2 kV) is equal to the reference voltage, the output from comparator U3A (signal –STOP) switches to zero. That stops the high-voltage generator controlled through microcontroller U12, which switches the GEST signal to low.

INPUT INTERFACE CIRCUIT

The input interface circuits are made up of drivers U10C, U10D, U10E and AOP U9A, U9B. Circuit U10D makes up the interface circuit of signal SACHARGE which triggers the high-voltage capacitor charge. Safety discharging while charging or during the hold phase is triggered by signal WDUMP generated by the CPU PCB and interfaced by driver U10C. Signal SYNCDEF generated by the CPU PCB synchronises the shock in the event of cardioversion through driver U10E. The signal also drives the second discharging channel (hardware) through driver U10F. The shock (first channel) is triggered with the help of two comparators U9A and U9B. The output of U9A is active when high (signal DISCH1). The output of U9B is active when low (signal -DISCH2). Charging is disabled during safety discharging by comparator U11B which checks that there is no voltage at the terminals of the high-voltage capacitor (signal HVMES2) before starting up charging. Signal –HVPRES is active when low. Comparator U2B is used to detect any malfunctioning in the charging transistor (T10) on the high-voltage circuit through the CHARGEN signal. Any short circuit at the charging transistor (T10) is detected during the standby phase and can, if required, block the charging of the high-voltage transistor as T10 is part of the secondary circuit.

RESET CIRCUIT AND MICROCONTROLLER

All the charge/discharge cycle sequences are driven by microcontroller U12, namely:

- Charge triggering
- Charge disabling during the safety discharge
- Stopping the charge when the selected energy value is reached
- Limiting the maximum duration of the charging phase to 20 seconds
- Controlling the hold phase, also limited to 20 seconds maximum
- Generating a 16-ms clock signal

- Activating and delaying the discharge phase, duration limited to 160 ms
- Resetting and setting off the safety discharge
- Triggering the shock in the direct mode
- Triggering the shock in the synchronised mode
- Setting off a battery test cycle.

Microcontroller U12 is powered by a + 5 V voltage supplied by the high-voltage circuit. Circuit U18 monitors the power supply voltage and resets the microcontroller (- MCLR) when the device is switched on. If there is any technical fault, U18 also resets the microcontroller through comparator U15A, associated components and the safety switch (U13A). U12 is controlled by quartz (Q1) with an oscillation frequency of 4.0 MHz. Besides, the microcontroller supplies an output signal (WDCLK) that makes it possible to check functioning. Signal WDCLK has an invariable 16-ms period.

OUTPUT INTERFACE CIRCUITS

The output interface circuits are made up of drivers U10A, U10B, U8A, U8B, U8C, U8D, U8E and U8F. Circuit U14A supplies a high-level output, either through signal STARTDEF or through signal TBAT (in battery test mode).

The output of U14A is used to control the charging transistor (T10) on the high-voltage circuit by means of the -CHARGEDR signal via U10B. If a technical fault is detected by the safety circuit (U13A), transistor T1 is saturated, which imposes a low level at the input of U10B, which blocks the charging transistor (T10) of the high-voltage circuit and therefore stops the high-voltage generator (if it is charging the high-voltage capacitor) and leads to a safety discharge of the high-voltage capacitor. Signal STARTDEF (supplied by the microcontroller), which activates the safety discharge relay, is buffered with U8B. The high-voltage generator control signal (GEST) is buffered with U8A. The signal comes from U14B and originates from the LOADC signal output by the microcontroller (U12) during high-voltage capacitor charging or the TBAT signal during the battery test. The discharge validation transistor (T11) on the high-voltage board is activated by U10A, which is controlled by the CFULL signal (hold phase). Transistor (T12) (triggering the shock on the first channel) on the high-voltage PCB (W4P14 1721) is made to conduct by signal DISCH. The defibrillator status signals transmitted to the CPU PCB are as follows: DEFCHARGE, DEFREADY, DEFDISCH and SECDISCH buffered by U8E, U8D, U8F and U8C respectively. The status signal of the safety switch (U13A) is –DEFSEC.

PULSE BIPHASIC WAVEFORM CONTROL CIRCUIT

The control circuit of the pulse biphasic waveform is made up of circuits U4, U5 and U7, associated with gates U6A, U6B and U6C. During the charging and hold phases, the IGBTs of the high-voltage switching circuit are blocked actively by signals PREPULSE 1 and PREPULSE 2. These blocking signals are generated from signal WDCLK (16 ms) supplied by U12 and differentiated by R71 and C28. The pulses shaped by U3B have a 100-µs duration and are switched by U6B, U6A and U6C. During the shock, when signal –DISCH switches to low, oscillator U7, counter U5 and EPROM U4 are activated. The IGBT driving signals (conduction and blocking) are generated by four EEPROM data bits (U4).

- Datum D1 of U4 (PHASE1) gives rise to phase-1 IGBT conduction periods through driver (U2) on the high-voltage PCB during the shock
- Datum D3 of U4 (PHASE2) gives rise to phase-2 IGBT conduction periods through driver (U2) on the high-voltage PCB during the shock
- Datum D4 of U4 gives rise to phase-1 IGBT active blocking periods through U10G, U6C and driver (U1) on the high-voltage PCB
- Datum D5 of U4 gives rise to phase-2 IGBT active blocking periods through U10H, U6A and driver (U1) on the high-voltage PCB

7. OPERATING EXPLANATIONS

SAFETY SWITCH AND MONITORING CIRCUIT

The safety circuit deactivates the defibrillator (resets microcontroller U10) and runs a safety discharge of the energy stored in the high-voltage capacitor. The safety functions are as follows:

- Monitoring the functioning of the charging transistor (T10)
- Monitoring transistor T12
- Monitoring transistor T13
- Monitoring signal WDCLK
- Monitoring the insulation faults of the IGBTs of the high-voltage switching circuit
- Detecting voltage surges if there is an end-of-charge fault

The safety circuit is made up of number of comparators (U11, U16 and U17), which set off the safety switch (U13A) through U15B if a technical fault is detected. When the device is started up, the safety switch (U13A) is triggered by the charging of capacitor C9 and comparator U15B in order to check operation through signal –DEFSEC (active when low). All charging cycles or battery tests are preceded by a reset of the safety switch by the SECRST signal generated by microcontroller U12. The setting off of the safety switch (in the event of a technical fault) stops the high-voltage generator and leads to a safety discharge of the high-voltage capacitor by making T1 conduct. Besides, circuits U15A and U18 reset U12 in the event of a technical fault.

MONITORING OF CHARGING TRANSISTOR T10

Charging transistor (T10 on the high-voltage circuit) is monitored by divider R10, R11 (high-voltage circuit) and comparator U2B.

MONITORING OF TRANSISTORS T12 AND T13

Patient relay activation transistors (T12 and T13 on the high-voltage circuit) are monitored by window comparators U16A and U16B and circuits U17A, U17D and associated components.

MONITORING OF SIGNAL WDCLK

Signal WDCLK is monitored by comparator U17B and associated components.

MONITORING THE INSULATION FAULTS OF THE IGBTS OF THE HIGH-VOLTAGE SWITCHING CIRCUIT

The insulation faults of the IGBTs of the high-voltage switching circuit are monitored by resistors R69 and R70 installed on the high-voltage switching circuit, connected by the grey wire to pin J2 of the high-voltage circuit. If there is any insulation fault in a high-voltage switching IGBT, the amplitude of signal HVMES2 is distorted. In that case, the fault is detected by the CPU PCB (upper part), which switches signal WDUMP to high to activate the safety discharge of the high-voltage capacitor. Besides, the CPU PCB generates an error message on the LCD screen if that happens.

DETECTING VOLTAGE SURGES IF THERE IS AN END-OF-CHARGING FAULT

Voltage surges if there is a fault in the end-of-charging circuit are detected by comparator U11A, which monitors the amplitude of signal HVEMS2. The triggering limit in the event of a surge is approximately 5.1 kV for the sum of the two charging voltages.

The outputs of all the open-collector comparators of the safety circuit are interconnected. If a technical fault is detected, they set off the safety switch through comparator U15B. The reference limit for the comparators of the safety circuit is provided by the voltage reference DZ2, which is itself monitored through U17C.

7.3.5. HIGH-VOLTAGE SWITCHING circuit board

The HIGH-VOLTAGE SWITCHING PCB (W4P14 1724) makes up the high-voltage and high-current chopping unit which generates defibrillation by means of a pulse biphasic waveform.
The circuit is connected to the HIGH-VOLTAGE CIRCUIT (W4P14 1721) and the high-voltage capacitor (30 µF / 3.6 kV and 30 µF / 1.2 kV). The HIGH-VOLTAGE SWITCHING circuit includes control signal interface components, high-voltage switching components (IGBTs) and the patient insulation relay.

The HIGH-VOLTAGE SWITCHING PCB is made up of the following:
- phase 1 IGBT control circuit
- phase 2 IGBT control circuit
- IGBT type high-voltage switching circuits
- patient insulation circuit with relays

OVERVIEW

The HIGH-VOLTAGE SWITCHING PCB (W4P14 1724) performs the following functions:
- synchronised generation of IGBT control pulses for defibrillation with a pulse biphasic waveform
- patient insulation from the high-voltage circuit of the defibrillator section

In general, the terms PHASE 1 and PHASE 2 refer to the two phases of the pulse biphasic discharge curve delivered by **MULTIPULSE BIOWAVE FRED®** (see waveform on pages 1 to 7).

PHASE 1 IGBT CONTROL CIRCUIT

Phase 1 of the pulse biphasic defibrillation waveform is made up by driving IGBTs T1, T2, T3, T4 and T5, T6, which are connected to the 30 µF / 3.6 kV high-voltage capacitor. The synchronised control of T1 to T6 is performed by the simultaneous induction of the driving cores of grids L1, L2 and L3. Zener diodes (DZ1 to DZ12) make up the IGBT grid clipping components. The grids are driven via the cores by current pulses in the control wire connected to J14 and J16. The current pulses in the control wire are generated by transistors T13 and T14, for the active blocking and conduction of the IGBTs respectively. The control signals of transistors T13 and T14 are PREPHI 1 and PHI 1 respectively, generated on the defibrillator control circuit (W4P14 1722), buffered by the high-voltage circuit (W4P14 1721). T15 is the validation transistor of the pulse biphasic waveform and is controlled by transistors T11, T14 and T15 of the high-voltage circuit. The current in the control wire is limited by R7, R8 and R9.

PHASE 2 IGBT CONTROL CIRCUIT

Phase 2 of the pulse biphasic defibrillation waveform is made up by driving IGBTs T7, T8, and T9, which are connected to the 30 µF / 1.2 kV high-voltage capacitor. The synchronised control of T7 to T9 is performed by the simultaneous induction of the driving cores of grids L4, L5 and L6. Zener diodes (DZ13 to DZ24) make up the IGBT grid clipping components. The grids are driven via the cores by current pulses in the control wire connected to J15 and J17. The current pulses in the control wire are generated by transistors T10 and T11, for the active blocking and conduction of the IGBTs respectively. The control signals of transistors T10 and T11 are PREPHI 2 and PHI 2 respectively, generated on the defibrillator control circuit (W4P14 1722), buffered by the high-voltage circuit (W4P14 1721).

T12 is the validation transistor of the pulse biphasic waveform and is controlled by transistors T11, T14 and T15 of the high-voltage circuit. The current in the control wire is limited by R7, R8 and R9.

IGBT TYPE HIGH-VOLTAGE SWITCHING CIRCUITS

The high-voltage and high-current switching circuits are made up by associating IGBTs.

The phase 1 switching channel is made up of IGBTs T1, T2, T3, T4, T5 and T6. These IGBTs make up a series assembly of 3 x 2 IGBTs mounted in parallel. The synchronous control of the various IGBTs outputs the first phase of the pulse biphasic waveform by means of the chopping discharge of the 30 µF / 3.6 kV capacitor. Resistors R1, R2 and R3 associated with each pair of IGBTs make up an IGBT potential balancing chain.

The phase 2 switching channel is made up of IGBTs T7, T8 and T9. These IGBTs make up a series assembly of 3 IGBTs. The synchronous control of the various IGBTs outputs the second phase of the pulse biphasic waveform by means of the chopping discharge of the 30 µF / 1.2 kV capacitor. Resistors R4, R5 and R6 associated with the IGBTs make up an IGBT potential balancing chain.

PATIENT INSULATION CIRCUIT WITH RELAYS

The high-voltage switching circuit also performs the function of insulating the patient by means of relays RL1 and RL2. The coils of the two relays are connected in series. The activation of relays RL1 and RL2 is controlled by transistors T11, T12 and T13 of the high-voltage circuit (W4P14 1721). The patient insulation relay (RL1 and RL2) activation duration is 160 ms, which is equal to the duration of the DISCH signal that controls transistor T12.

7.3.6. ECG PREAMP PROTECTION printed circuit board

The ECG PREAMP PROTECTION PCB (W4P14 1723) electrically connects the ECG signals from the adhesive defibrillation electrode connector to the defibrillation ECG preamplifier circuit located in the upper part.

The PCB is made up of the following:

- Stage for protecting the ECG preamplifier from defibrillation shocks
- Stage for protecting the patient impedance measurement circuit from defibrillation shocks
- Circuit designed to measure the contact impedance of the adhesive electrodes.

OVERVIEW

The ECG PREAMPLIFIER PROTECTION PCB (W4P14 1723) is made up of two parts:
The first part contains the components that protect and clip the defibrillation shock, associated with an oscillator for measuring the patient impedance. The second part contains the components that protect and clip the defibrillation shock, associated with two unit-gain followers for transmitting the ECG signal to the defibrillation ECG preamplifier of the upper part.

CONTACT IMPEDANCE MEASUREMENT

The frequency generator dedicated to measuring the contact impedance is built around U2. It delivers a 20-kHz sinus signal. The signal is injected in the patient through R4, R6, R3, C1, C2, R5, C3, C4 and R1, R2. The signal between J1 and J2, which is made up of the ECG signal and the 20-kHz signal that is the patient contact impedance image, is transmitted to the defibrillation preamplifier through R7, R8, R10, R9, L1, L2 and U1A, U1B. The signals at the output of U1 (J3 and J4) are connected to the defibrillator ECG preamplifier in the upper part of **MULTIPULSE BIOWAVE FRED**®.

PROTECTION FROM DEFIBRILLATION SHOCKS

The 20-kHz generator is protected by the capacitive coupling of C1, C2, C3 and C4 associated with resistors R7, R8 and sparker E1, then supplemented by a final clipping system built around DZ1, DZ2, R3, R4, and R5, R6.
The amplifier chain is protected by power resistors R7, R10 associated with sparker E2. An additional clipping system is built around R8, R9, DN1 and DN2 and is used to bring the residual voltage following a defibrillation shock within the range of power supply voltages +VFD and –VFD.
Power supply voltages +VFD and –VFD are generated on the defibrillation ECG preamplifier PCB in the upper part. The two reference voltages DZ5 and DZ6 supply polarising voltages for clipping diodes DN1 and DN2.

7.3.7. INSULATION AND SHIELDING printed circuit board

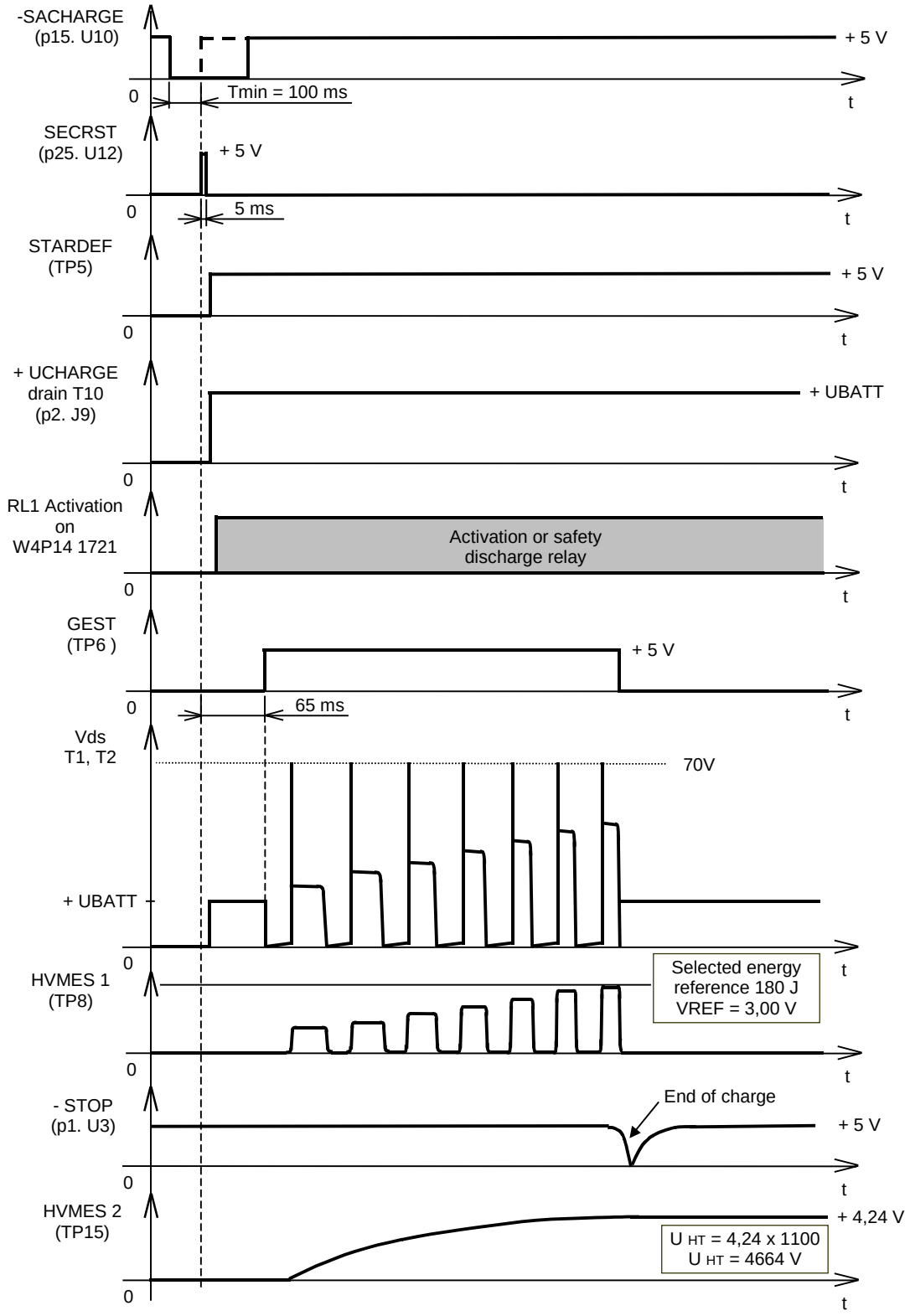
The INSULATION AND SHIELDING PCB (W4P14 1725) provides mechanical protection for the circuits of the defibrillator part, and additional electrical insulation between the high-voltage part of the defibrillator and the upper part. Besides, the insulation and shielding circuit includes conductive coating (connected to the ground by the fixing piece screws) in order to make the upper part more immune to disturbance during defibrillation shocks.

7.3.8. Timing charts of the defibrillator part

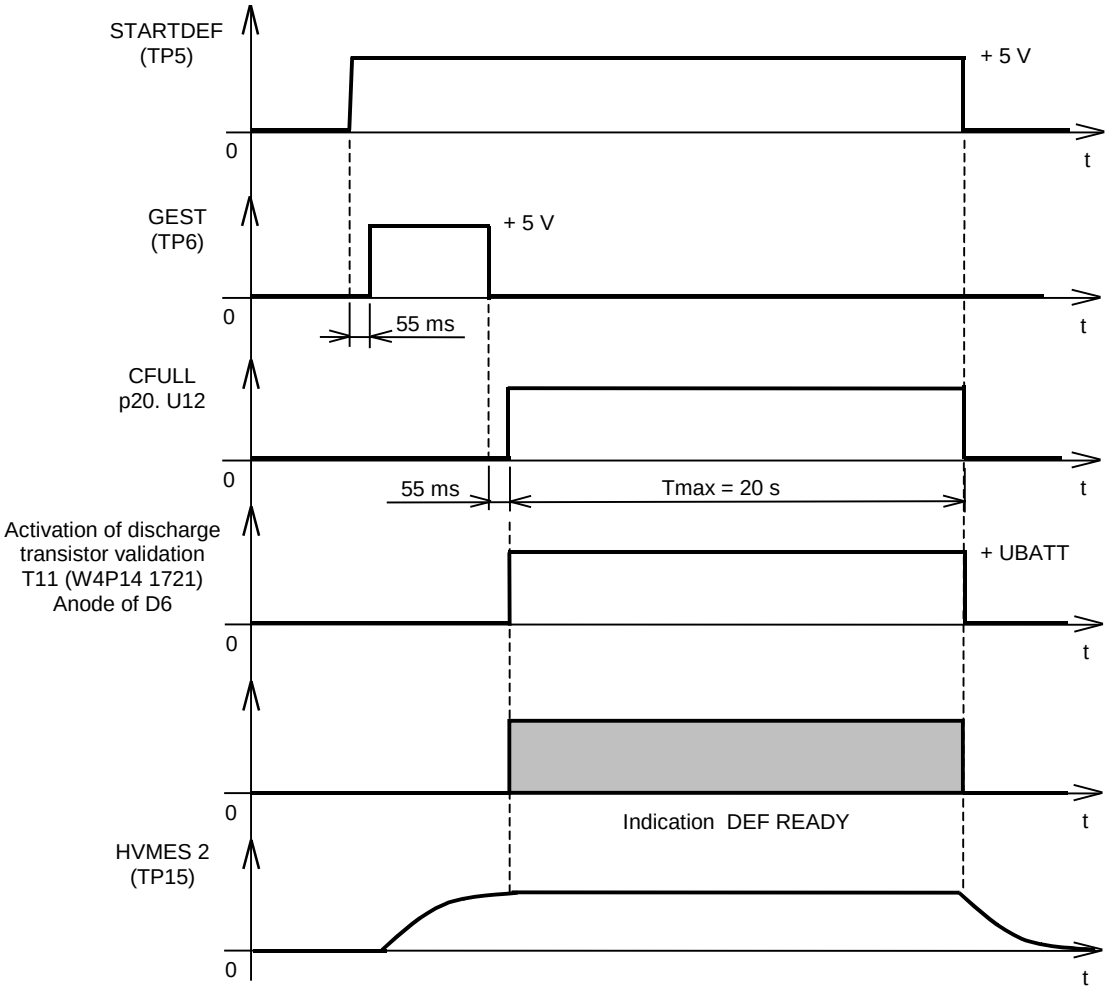
The pages below provide timing charts relating to the various phases of the defibrillator part.
The timing charts are as follows:

- Charging phase timing chart
- Hold phase timing chart
- IGBT control signal timing chart
- Discharging phase timing chart

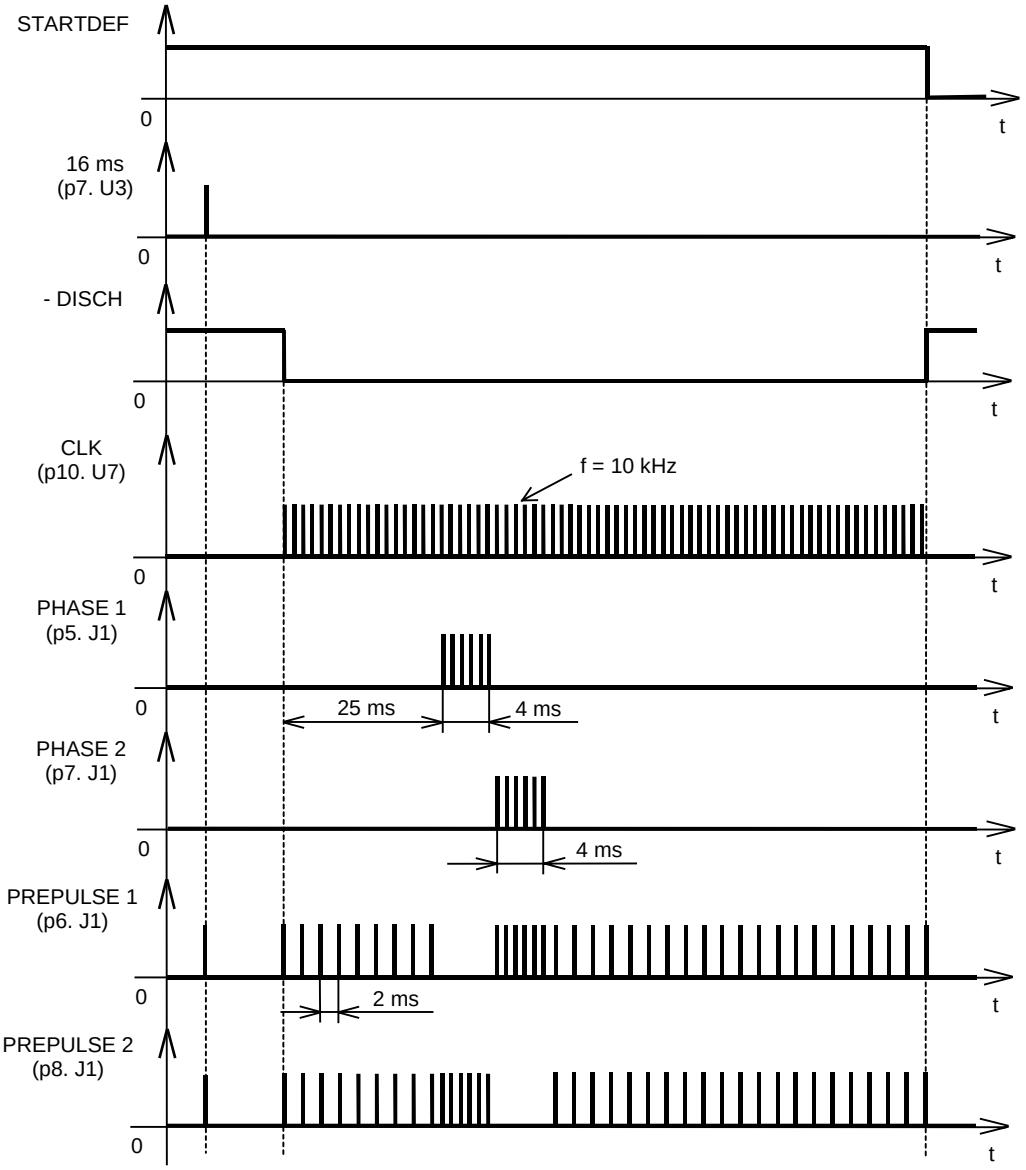
Charging phase timing chart



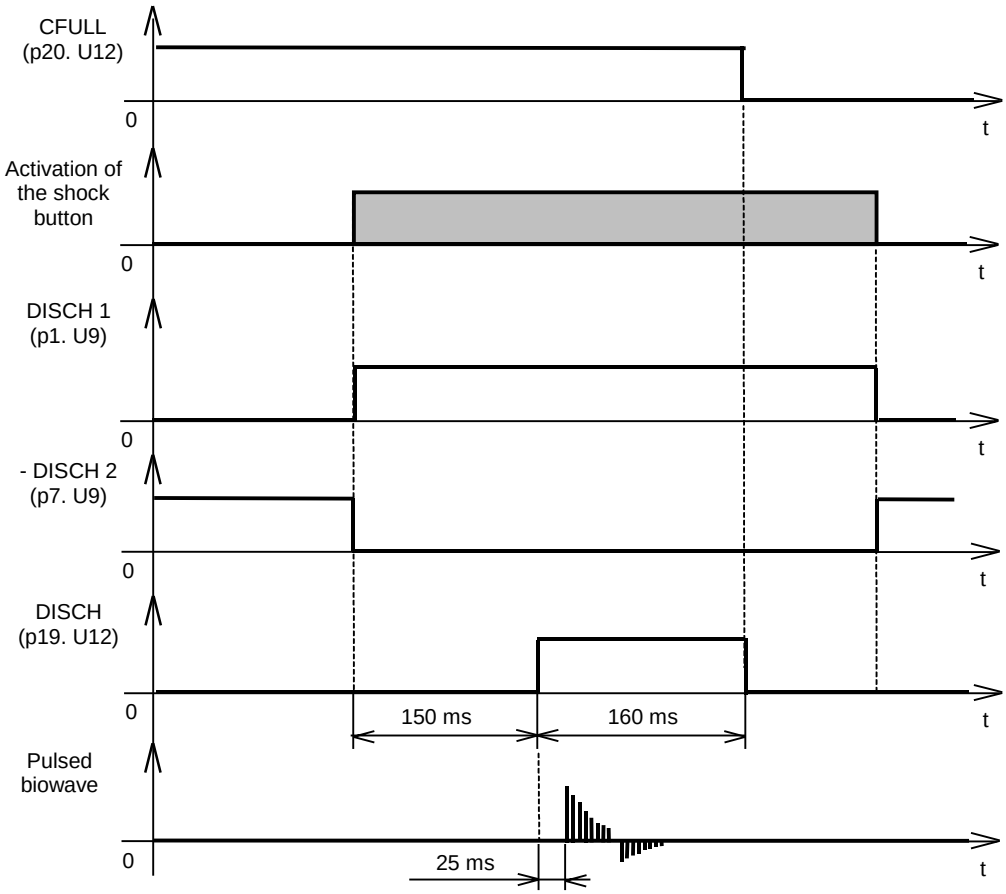
Hold phase timing chart



IGBT control signal timing chart



Discharging phase timing chart



8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS

8.1. COMPONENT ABBREVIATION LIST

Reference	Description
BAT	Battery – cell
BZ	Buzzer
C	Capacitor
CTR	Cathode ray tube
D	Diode
DN	Diode network
DP	LED display
DZ	Zener diode – voltage reference
E	Sparker
F	Fuse
FB	Ferrite bead
J	Connector – connection bar – Fast-on lug
JP	Jumper
L	Induction coil - core
LA	Lamp - indicator
LD	LED (light emitting diode)
HP	Speaker
P	Potentiometer
PB	Pushbutton
PF	Fuse-holder
Q	Quartz
R	Resistor – VD resistor
RA	Adjustable resistor
RB	Rectifying bridge
RG	Regulator
RL	Relay
RN	Resistor network
S	Support
SP	Solder pin
SW	Switch – sectioning switch
T	Transistor - IGBT
TN	Transistor network
TP	Test point
TR	Transformer
U	Integrated circuit – optocoupler

8.2. LIST OF SIGNALS USED IN THE DIAGRAMS

A[0-17]	HOST microcontroller address bus
AMEM[0 25]	Flash memory address bus
ANALYSE	Analyse/Shock key
AVDO	LCD monitor controller registry address signal
BVDMEM1	Detection of the saving voltage for SRAM memory cards
BVDMEM2	Detection of the saving voltage for SRAM memory cards
CHARGEN	High-voltage capacitor charging enabling signal (active on 1)
CHECKBAT	Battery voltage monitoring signal
CLDSTRT	Signal indicating the origin of the RESET signal
CONTR_DOWN	Decrease contrast key
CONTR_UP	Increase contrast key
CTS_SUBD9	Control signal of the serial link between the HOST microcontroller and the external modem
-CDMEM1	Signal of the presence of the flash memory card
-CDMEM2	Signal of the presence of the flash memory card
-CDNI/LI	Cadmium-nickel battery or lithium cell encoding signal
-CHARGEDR	Control signal of the charge validation transistor (T2) of the high-voltage capacitor (active on 0)
-CSADC	ADC selection signal (U37)
CSAUDIO	U33 output flip-flop selection signal
-CSDEFI0	U36 output flip-flop and U39 input flip-flop selection signal
-CSDEFI1	U35 output flip-flop and U41 input flip-flop selection signal
-CSECG_NF	UART selection signal, serial link between the HOST microcontroller and the 12-lead ECG preamplifier
-CSENREG	UART selection signal, serial link between the HOST microcontroller and the recording microcontroller
-CSFLASH	Flash memory card selection signal
-CSKEY	U40 input flip-flop selection signal
-CSLCD	LCD monitor controller selection signal
-CSMUX	U34 output flip-flop selection signal
-CSSpO2	UART selection signal, serial link between the HOST microcontroller and the SpO2 module

-CSSUBD9	UART selection signal, serial link between the HOST microcontroller and the external modem
-CSVF	UART selection signal, serial link between the HOST microcontroller and the fibrillation detection microcontroller
-CSVIDEO	Selection signal for communication from the HOST microcontroller to the video microcontroller
DCD_SUBD9	Control signal of the serial link between the HOST microcontroller and the external modem
DCIN	DC input voltage for battery charging
DEFCHARGE	Signal indicating the high-voltage capacitor charging phase (active on 1)
DEFDISCH	Signal indicating the defibrillation phase (active on 1)
DEFREADY	Signal indicating the defibrillator ready phase (active on 1)
DISCH	Discharge triggering signal from the microcontroller (active on 1)
DISCHKEY 1	Signal from the Analyse/Shock key
DISCHKEY 2	Signal from the Analyse/Shock key
DSR_SUBD9	Control signal of the serial link between the HOST microcontroller and the external modem
DTR_SUBD9	Control signal of the serial link between the HOST microcontroller and the external modem
D[0-7]	HOST microcontroller data bus
DMEM[0 7]	Flash memory card data bus.
DV[0 7]	LCD monitor data bus
-DEFSEC	Signal indicating a technical fault in the defibrillator (active on 0)
-DISCHENDR	Control signal of the discharge validation transistor (T11) (active on 0)
ECG X1000	ECG signal with gain value of 1000
-ECG_ON	12-lead ECG preamplifier power supply control signal
-ERRORVID	Video microcontroller status signal
GEST	High-voltage generator control signal (active on 1)
HVMES 1	High-voltage capacitor charging voltage measured with the high-voltage converter (TR1).
HVMES 2	High-voltage capacitor charging voltage measured with the high-voltage balancing resistors
HVMONIT	High-voltage capacitor charging voltage amplitude sent to the CPU
-INTUART	Association of interrupt signals from UARTs
-INT1	Association of interrupt signals from video microcontroller and defibrillator

LED1GREEN	Analysis indication LED
LED2GREEN	Analysis indication LED
LED3GREEN	Analysis indication LED
LED1RED	Defibrillator Ready indication LED
LED2RED	Defibrillator Ready indication LED
LED3RED	Defibrillator Ready indication LED
MODE_MEDICAL	Manual mode selection key
NTC	Cadmium-nickel battery or lithium cell recognition signal
ONBYKEY	Signal from the On/Off key
-OEMEM	Flash memory card reading signal
-ON/OFF	Signal from the On/Off circuit (active on 0)
PATCHLED	Adhesive defibrillation electrode connection indication LED
PATRL	Patient relay validation by T11
-PATRL	Patient relay activation by T12 and T13
PHASE1	Phase 1 control signal
PHASE2	Phase 2 control signal
PHI1	Buffered control signal for phase 1 IGBTs
PH2	Buffered control signal for phase 2 IGBTs
PHONE_TRANSM	Telephone transmission key
PREPHI1	Buffered control signal of the active blocking of phase 1 IGBTs
PREPHI2	Buffered control signal of the active blocking of phase 2 IGBTs
PREPULSE1	Active blocking control signal for phase 1
PREPULSE2	Active blocking control signal for phase 2
-PSEN	Reading validation signal
QRS_TRIG	QRS complex detection pulse
RAZENREG	Recording microcontroller reset signal
RAZSpO2	SpO2 module reset signal
RAZUART1	UART 1 reset signal (U25)
RAZUART2	UART 2 reset signal (U26)
RAZVID	Video microcontroller reset signal
RAZVF	Fibrillation detection microcontroller reset signal
RDYMEM	Status signal regulating communication between the recording microcontroller and the flash memory card
READY_VID	Status signal regulating communication between the HOST microcontroller and the video microcontroller

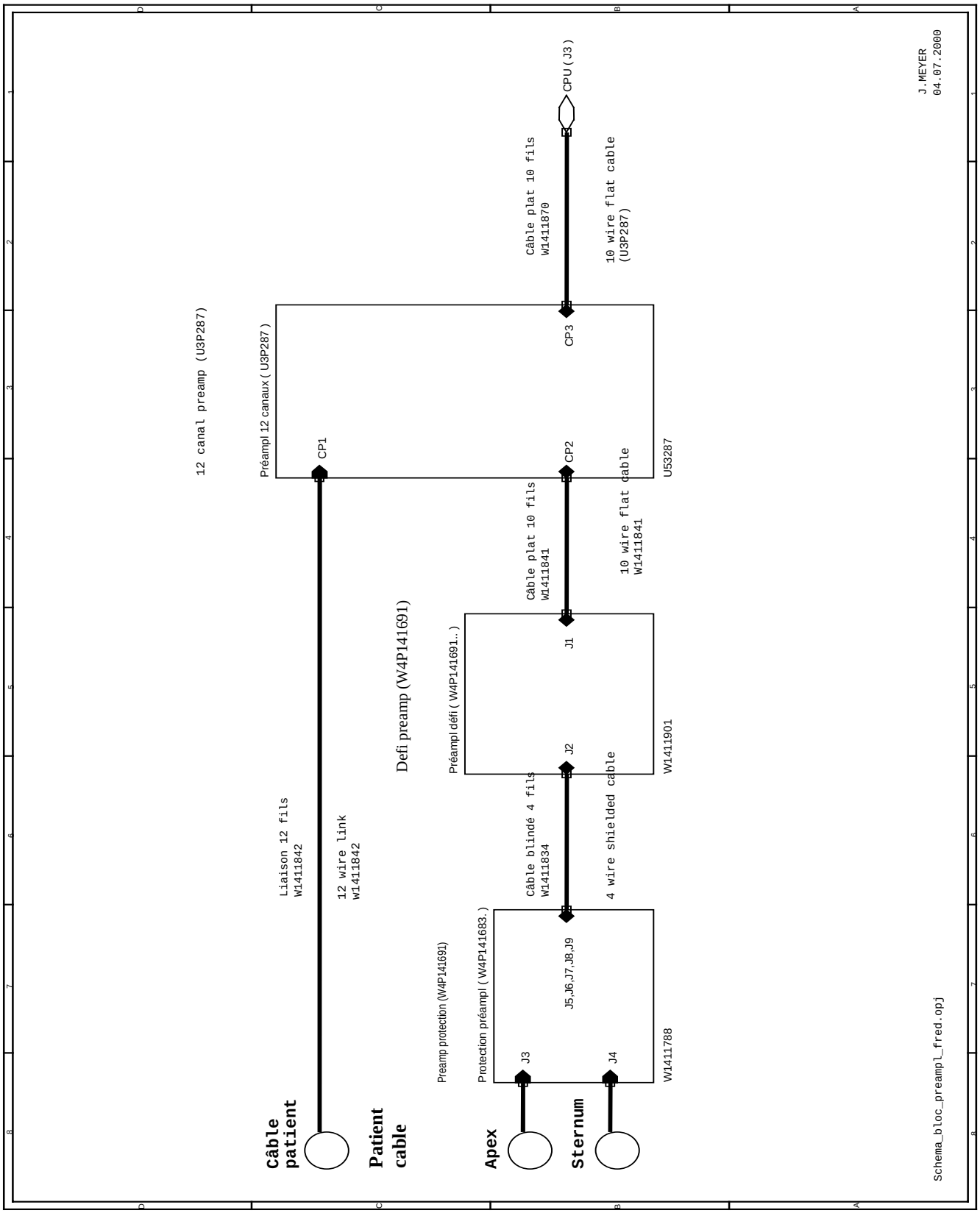
RESET	Reset signal (active on 1)
REVERSE	LCD monitor reverse video signal
RI_SUBD9	Control signal of the serial link between the HOST microcontroller and the external modem
RST_MEM	Flash memory card reset signal
RST_VID	LCD monitor controller reset signal
RTS_SUBD9	Control signal of the serial link between the HOST microcontroller and the external modem
RXD_ECG_NF	12-lead ECG preamplifier serial link reception signal
RXD_ENREG	Recording microcontroller serial link reception signal
RXD_SpO2	SpO2 module serial link reception signal
RXD_SUBD9	External modem reception signal
RXD_VF	Fibrillation detection microcontroller serial link reception signal
-REGMEM	Flash memory card registry selection signal
-RESET	Reset signal (active on 0)
-RD_VID	LCD monitor controller read signal
SACHARGE	High-voltage capacitor charge triggering signal (active on 1)
SAWSEL0	Energy selection in the AED mode
SAWSEL1	Energy selection in the AED mode
SAWSEL2	Energy selection in the AED mode
SAWSEL3	Energy selection in the AED mode
SECDISCH	Signal indicating the high-voltage capacitor safety discharge (active on 1)
STARTCONV	High-voltage generator activation signal in the battery test mode (active on 1)
START_CHARGE	Defibrillator charging key in the manual mode
STARTDEF	Charging/discharging cycle control signal (active on 1)
SYNCDEF	Defibrillation control signal in the direct / synchronised mode
+SPEAKER	Audio amplifier output signal to speaker
-SPEAKER	Audio amplifier output signal to speaker
-SYNCDR	Defibrillation control signal in the buffered synchronised / direct mode
TXD_ECG_NF	12-lead ECG preamplifier serial link transmission signal
TXD_ENREG	Recording microcontroller serial link transmission signal
TXD_SpO2	SpO2 module serial link transmission signal
TXD_SUBD9	External modem transmission signal

TXD_VF	Fibrillation detection microcontroller serial link transmission signal
-TESTVF	Reserved
U_BCKLIGH	BACKLIGHT CONVERTER power supply voltage
VOICE	Analogue signal for voice prompts
V_IN_PROGR	Status signal transmitted by the fibrillation detection microcontroller informing the HOST microcontroller that a voice prompt is in progress
VSMEM1	Flash memory card type recognition.
VSMEM2	Flash memory card type recognition.
WAITMEM	Flash memory card access delay signal
WDUMP	High-voltage capacitor safety discharge control signal
WPMEM	Flash memory write protection signal
WSEL_DOWN	Energy selection key in the manual mode
WSEL_UP	Energy selection key in the manual mode
-WEMEM	Flash memory write signal
-WR	Writing validation signal
-WR_VID	LCD monitor controller write signal
+UBATT	Battery power voltage
+UBATTF	Battery power voltage protected by an 8AT fuse
+UDEF	Power supply voltage of the defibrillator part
-VO	LCD screen contrast / polarisation voltage
+2,5VREF	+2.5V reference voltage
+5V	Power supply voltage of the circuits of the defibrillator part
+5VCPU	CPU part circuit power supply
+12V	Monitor part analogue circuit power supply
-12V	Monitor part analogue circuit power supply
-24V	LCD screen contrast / polarisation voltage

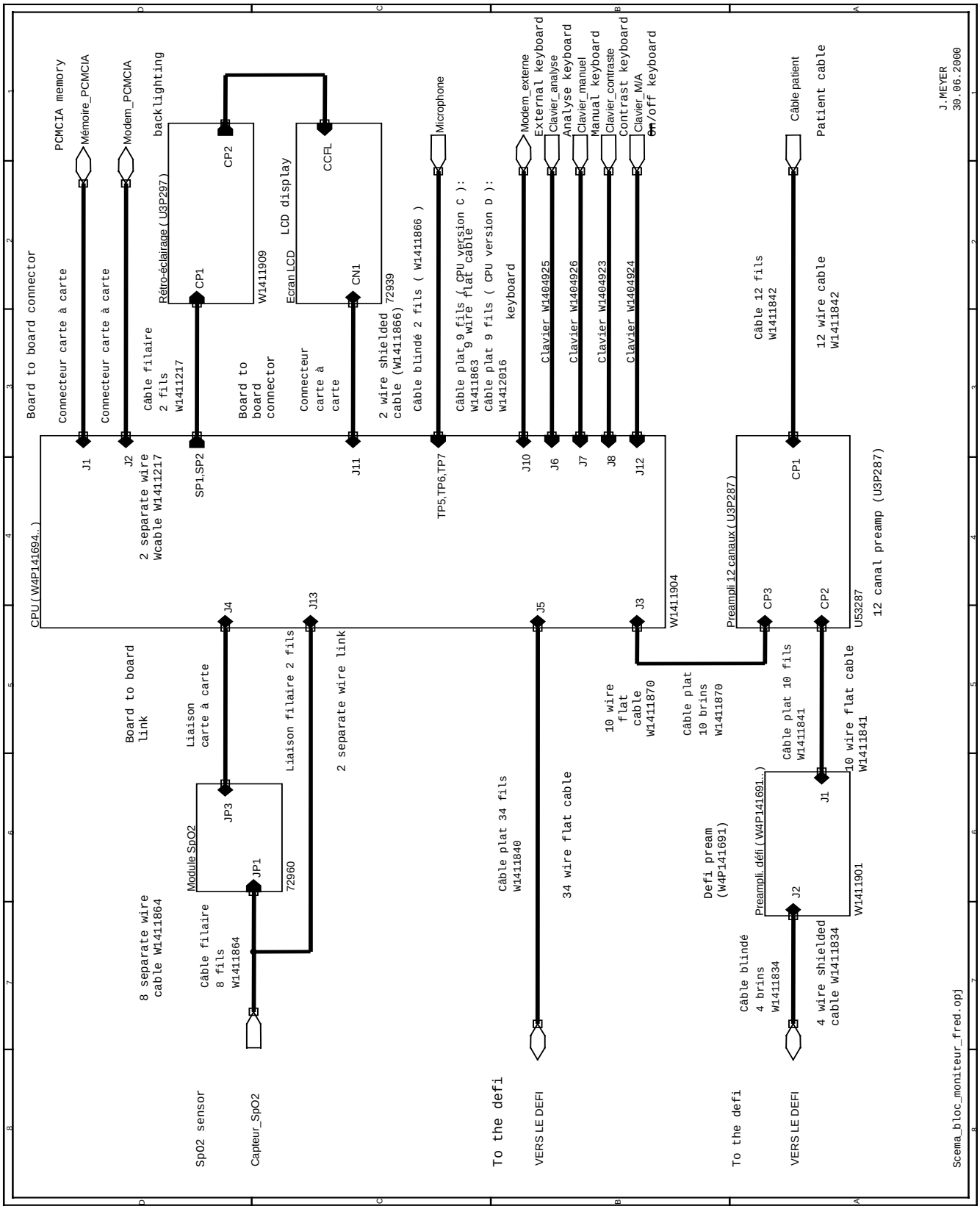
8.3. LIST OF PRINTED CIRCUIT BOARDS

Description	PCB number and versions	Article number of fitted PCB
12-lead ECG amp PCB	U3P287-1 U3P287-2	U53287
Defibrillation ECG PCB	W4P14 1691A W4P14 1691B	W141 1901
CPU PCB	W4P14 1694A W4P14 1694C W4P14 1694D	W141 1904
BACKLIGHT CONVERTER support PCB	U3P297-1	W141 1909
Battery Interface PCB	W4P14 1682	W141 1787
POWER SUPPLY PCB	U3P296-1	U53296
High-voltage PCB	W4P14 1721	W141 2006
Defibrillator control PCB	W4P14 1722 W4P14 1722A	W141 2007
High-voltage switching PCB	W4P14 1724 W4P14 1724A	W141 2009
ECG preamplifier protection PCB	W4P14 1723	W141 2008
Insulation and shielding PCB	W4P14 1725	W141 2010

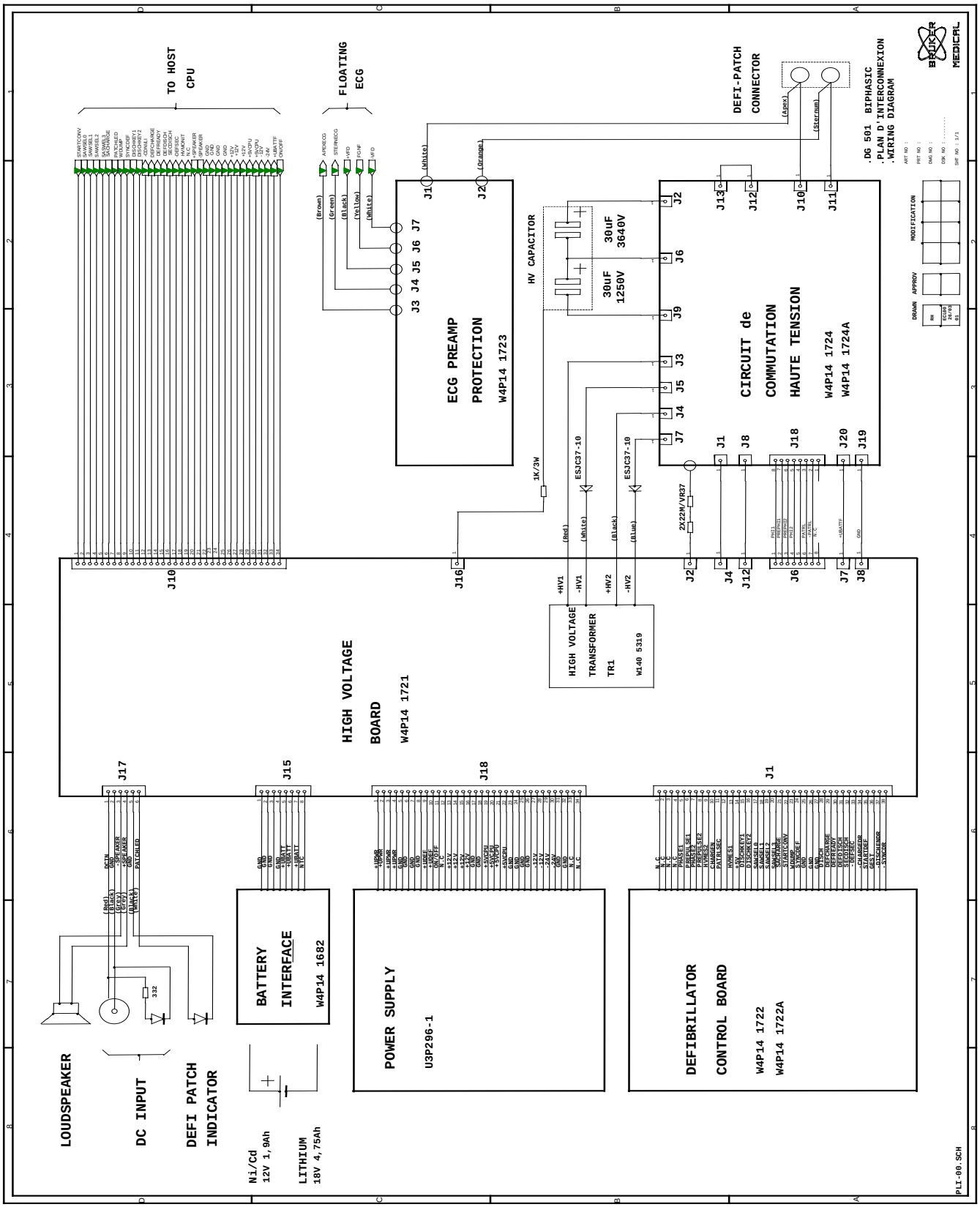
8.4. ECG PREAMP INTERCONNECTION DRAWING



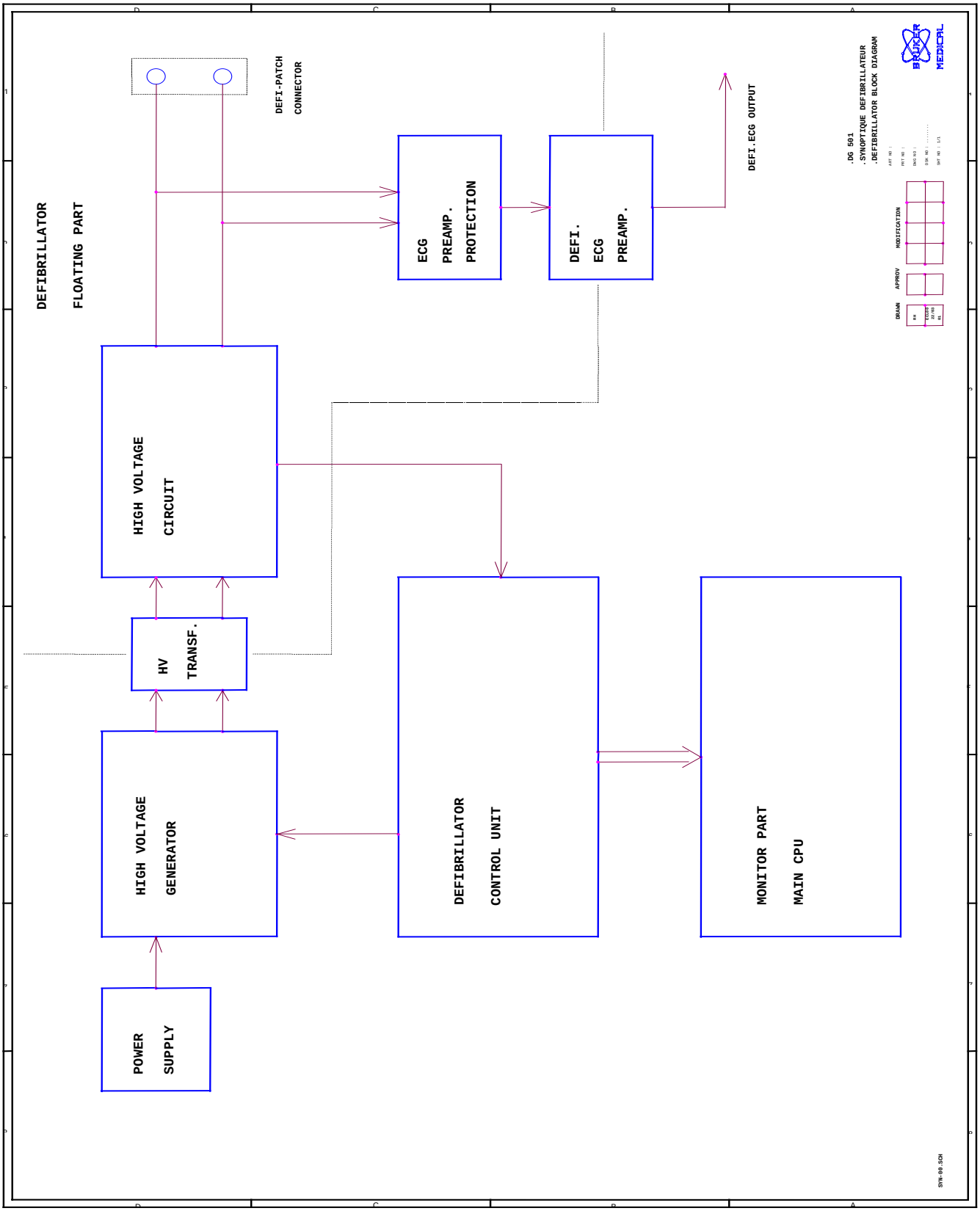
8.5. MONITOR PART INTERCONNECTION DRAWING



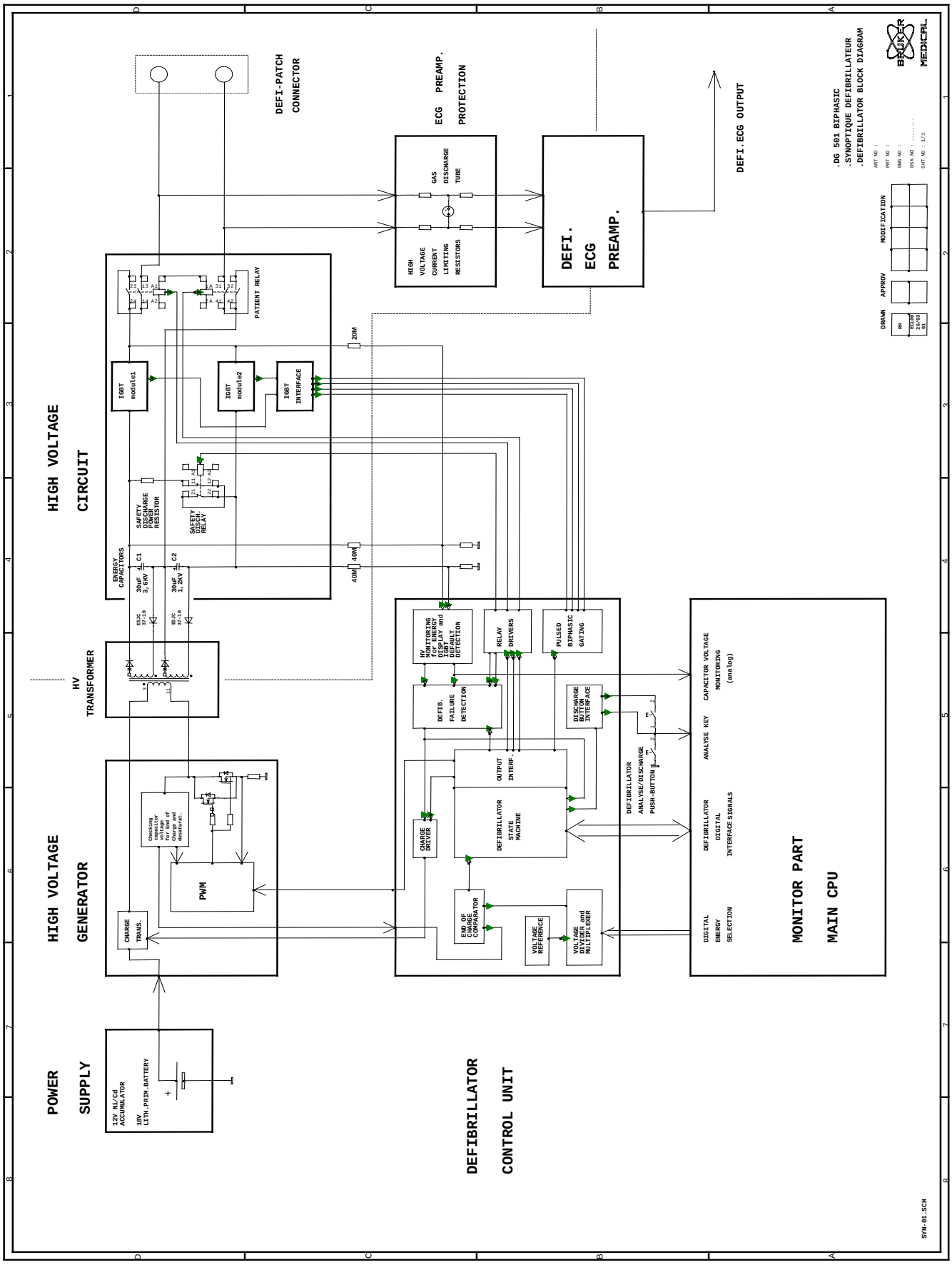
8.6. DEFIBRILLATOR PART INTERCONNECTION DRAWING



8.7. DEFIBRILLATOR PART DIAGRAM



8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS



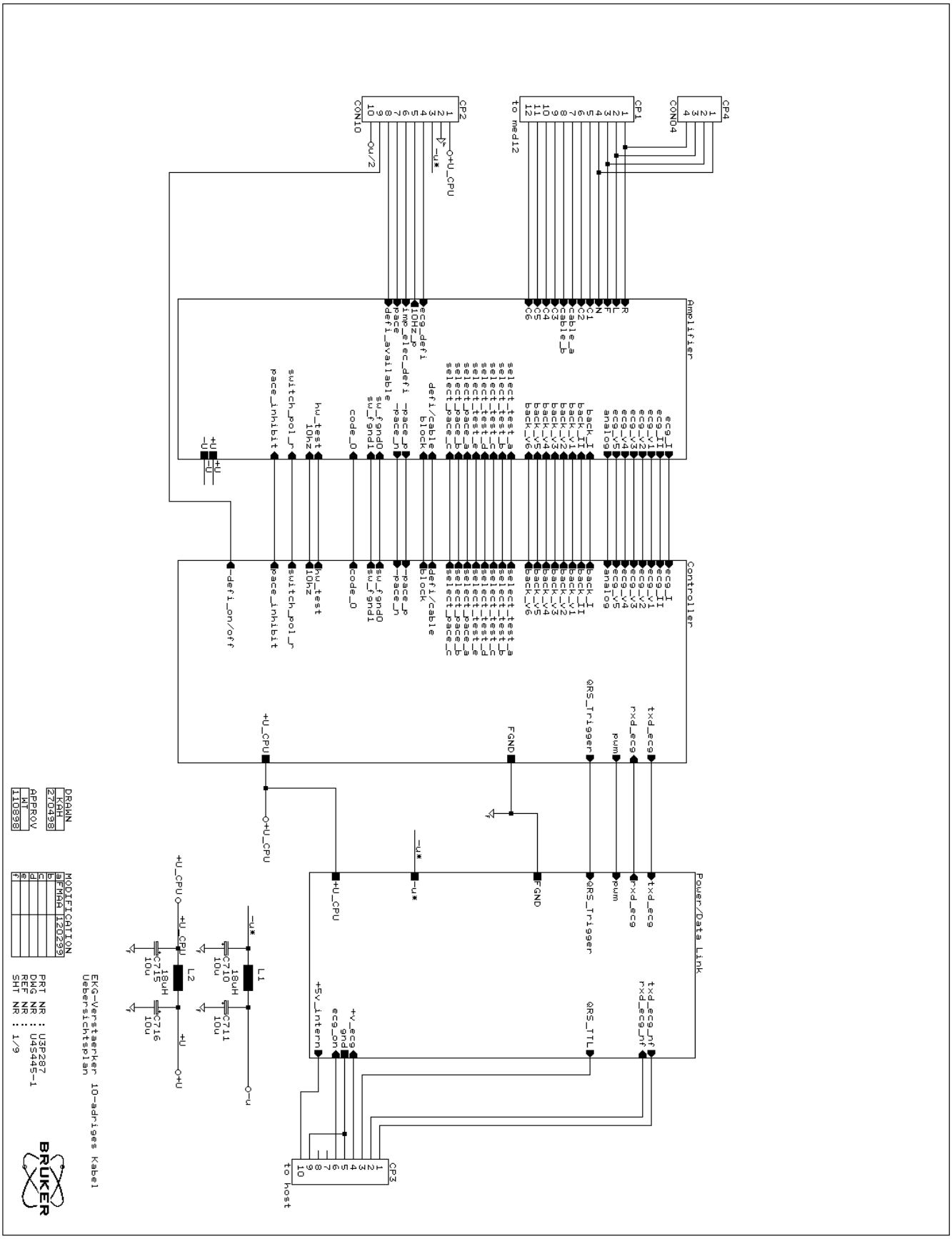
8.8. TWELVE-LEAD ECG AMP PRINTED CIRCUIT BOARD

Article no.: **U53 287**

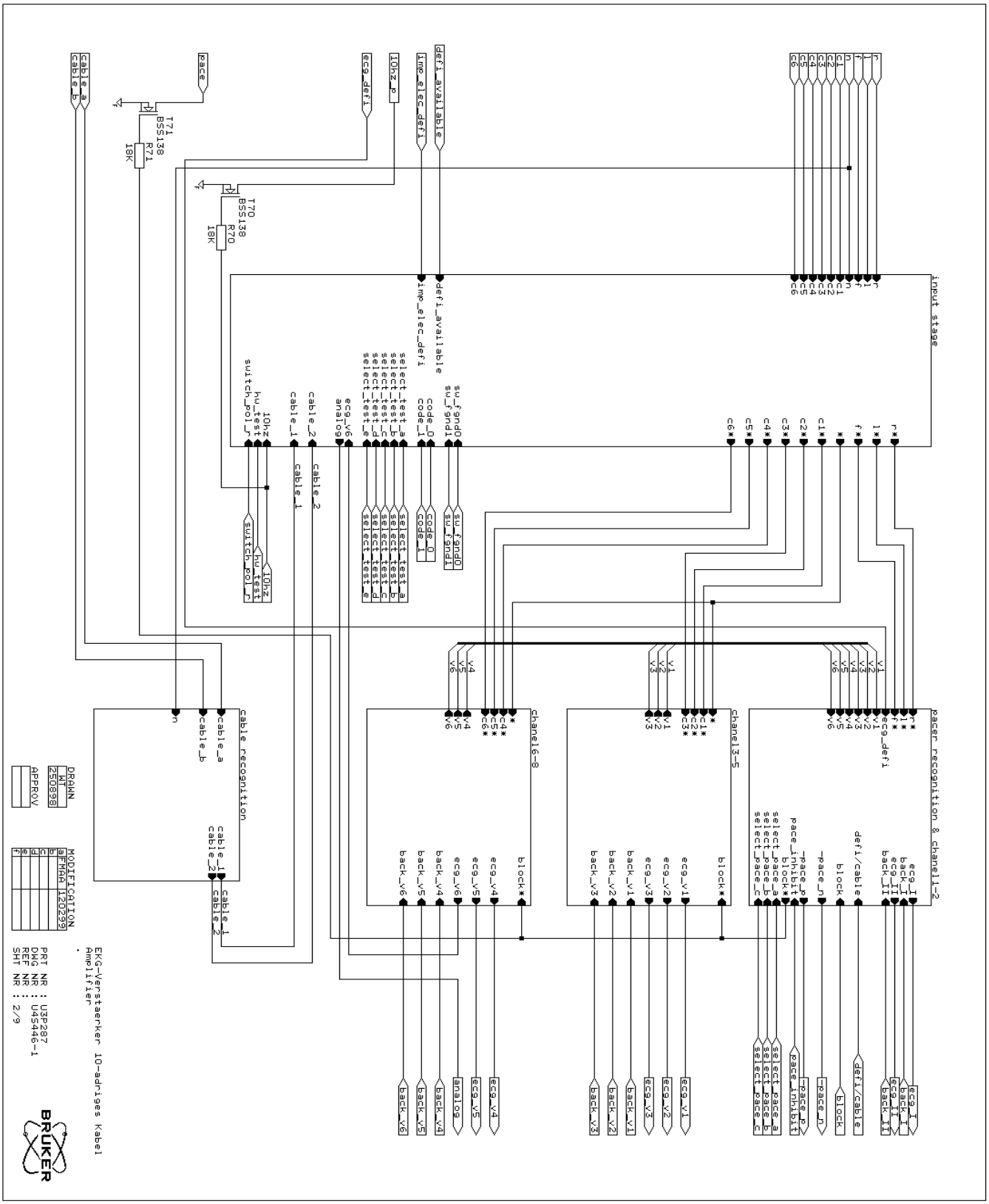
Description: **12-LEAD ECG AMP PCB**

Reference: **U3P287-1 or**
U3P287-2

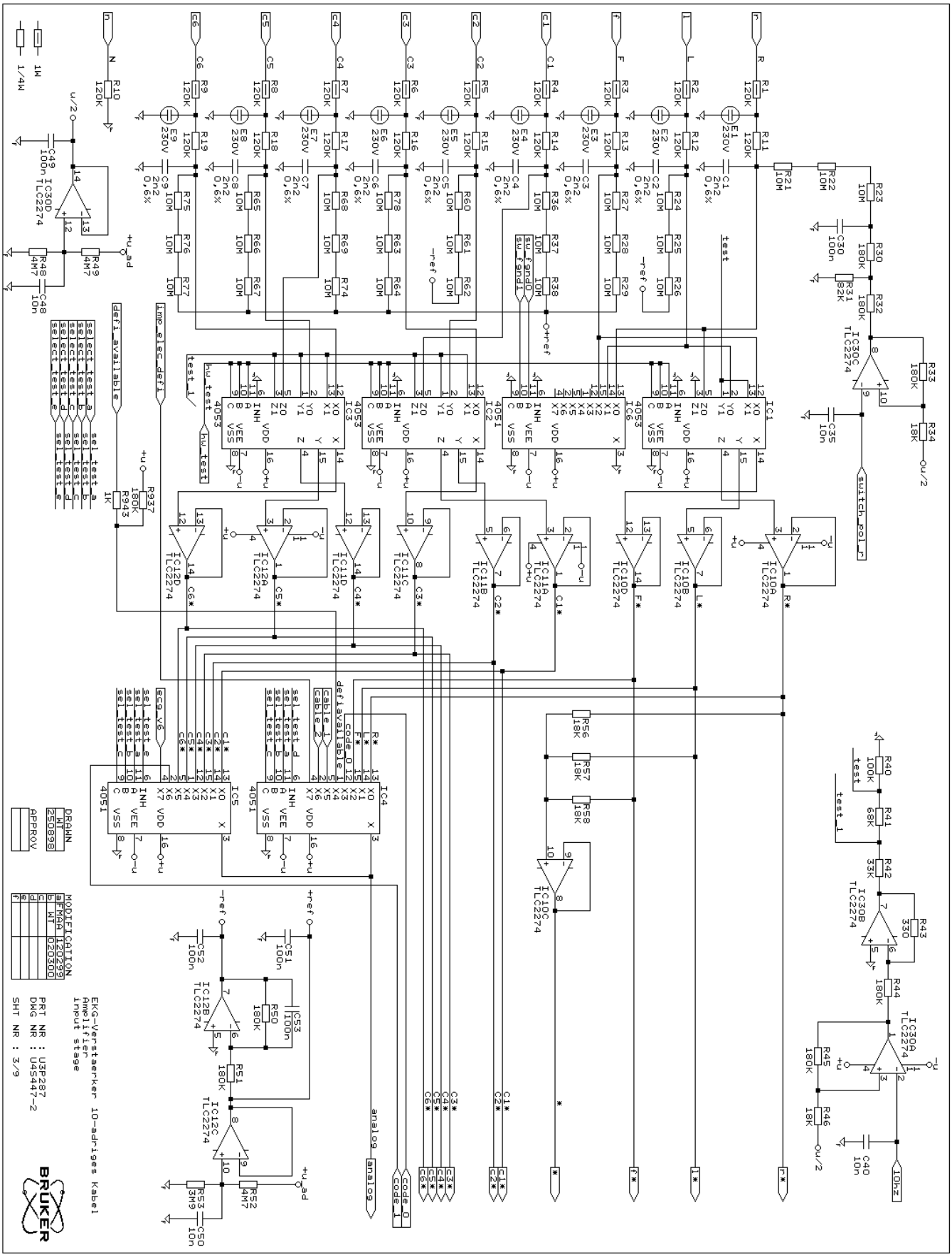
8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS

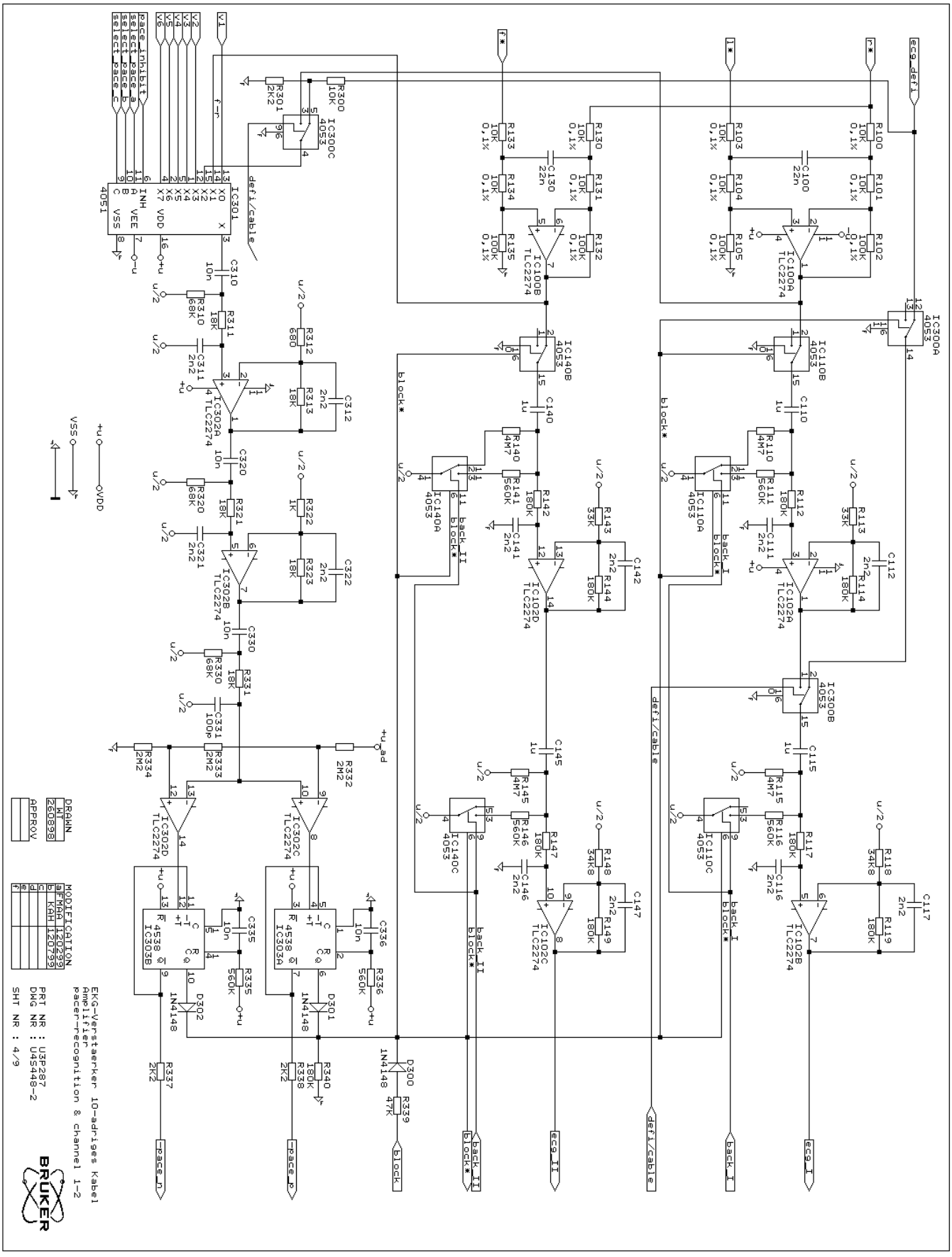


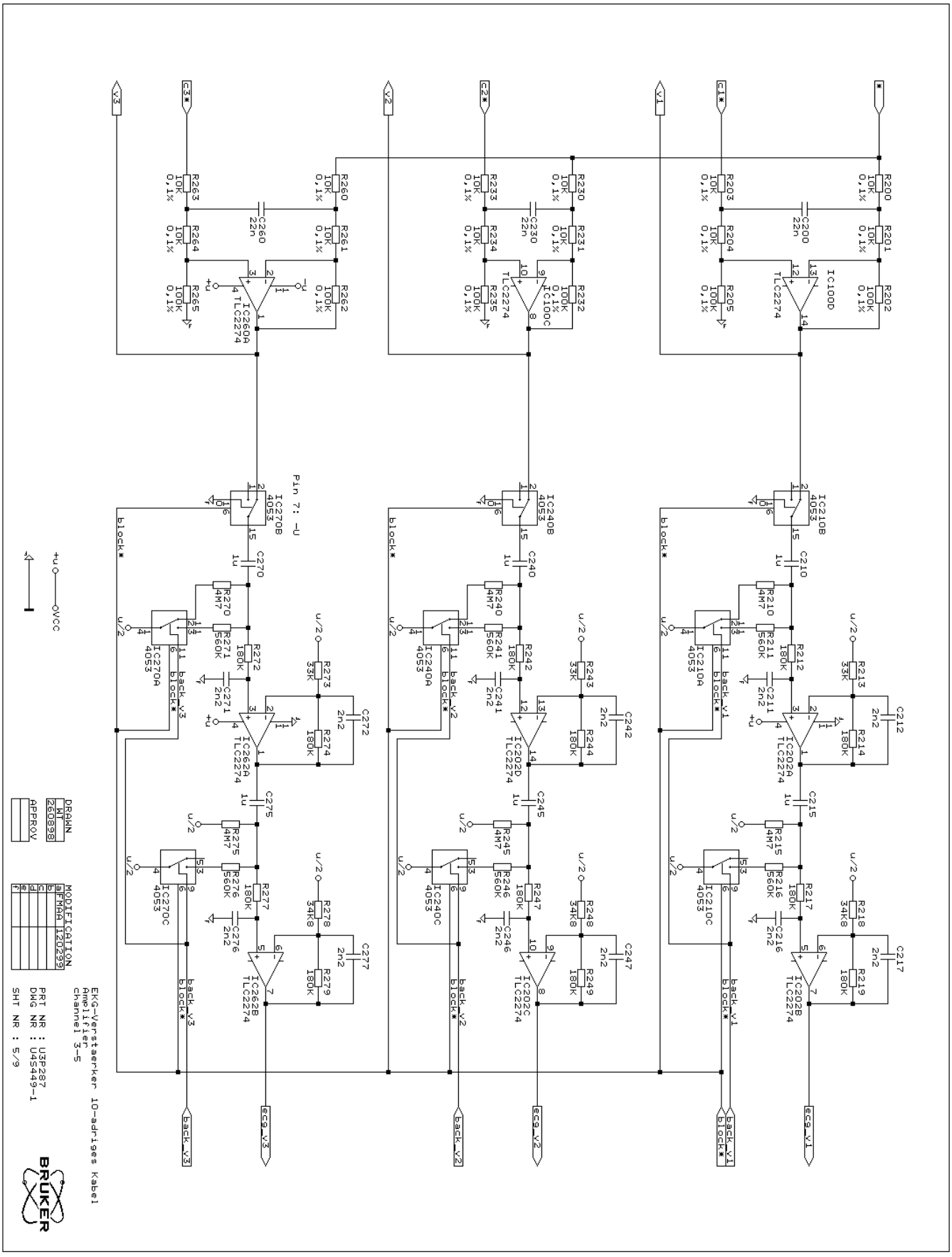
8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS

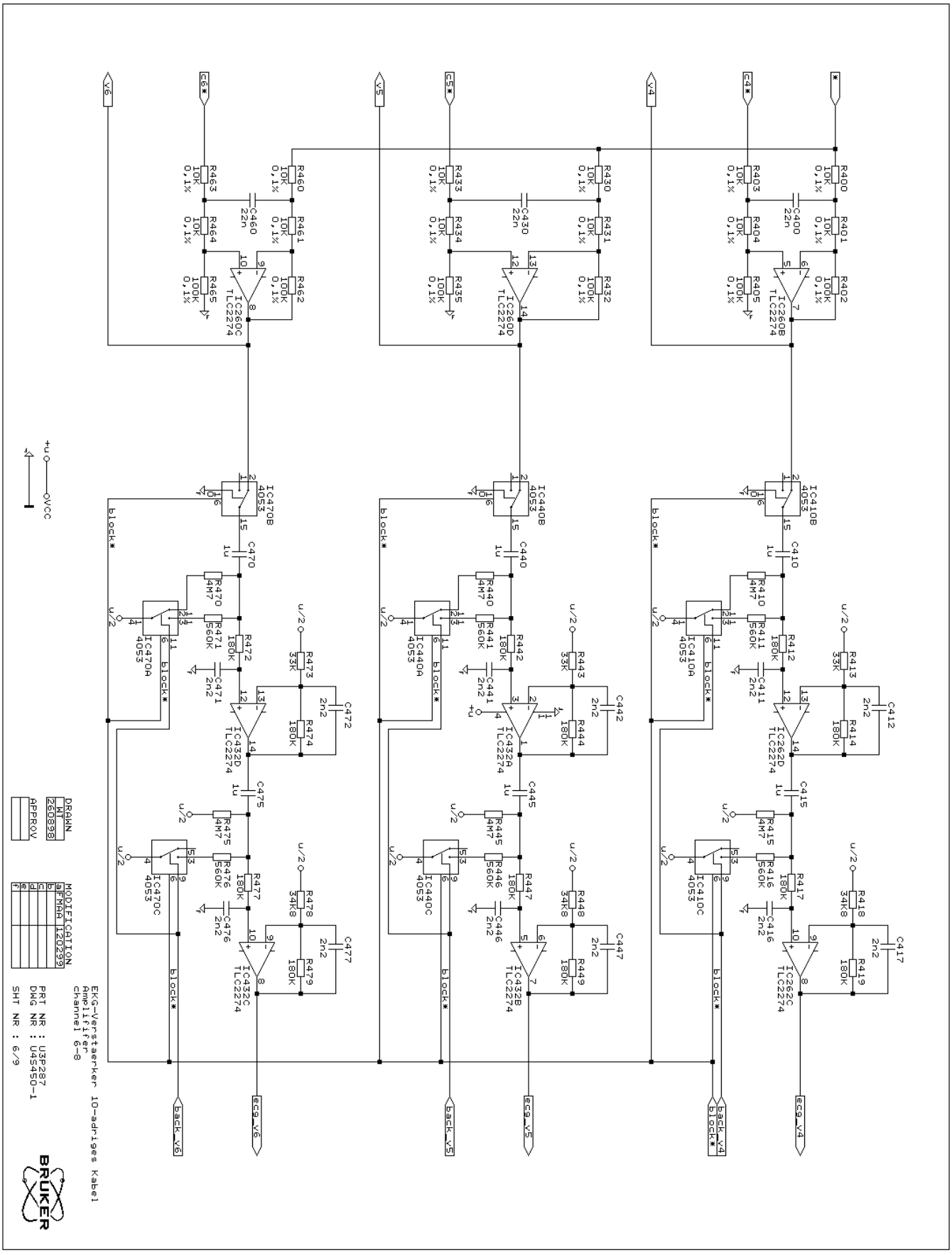


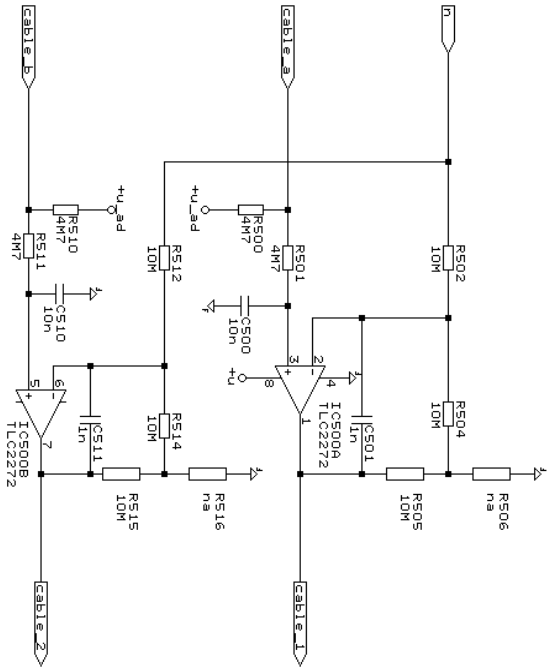
8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS




ecg_defi
f*
i*
r*
defi/cable
block*
back_II
back_I
ecg_II
ecg_I
+u_ad
-pace_n
-pace_p
EKG-Verstaerker 10-adriges Kabel
Amplifier, pacer-recognition & channel 1-2
PRT NR : U3P287
DWG NR : U45448-2
SHT NR : 4/9
BRUKER


EKG-Verstaerker 10-adriges Kabel
Amplifier Channel 3-5
PRT NR : U3P287
DWG NR : U45449-1
SHT NR : 5/9
DRAWN
MT
260898
APPROV
MODIFICATION
a FMAA 120299
+u
-u
VCC
block*
back_v3
back_v2
back_v1
ecg_v3
ecg_v2
ecg_v1
Pin 7: -U


EKG-Verstaerker 10-adriges Kabel
Amplifier 6-8
Channel 6-8
PRT NR : U3P287
DWG NR : U45450-1
SHT NR : 6/9
DRAWN
HT
260898
APPROV
MODIFICATION
a FMAN 120299
+u
0VCC



DRAWN
MT
260898

APPROV

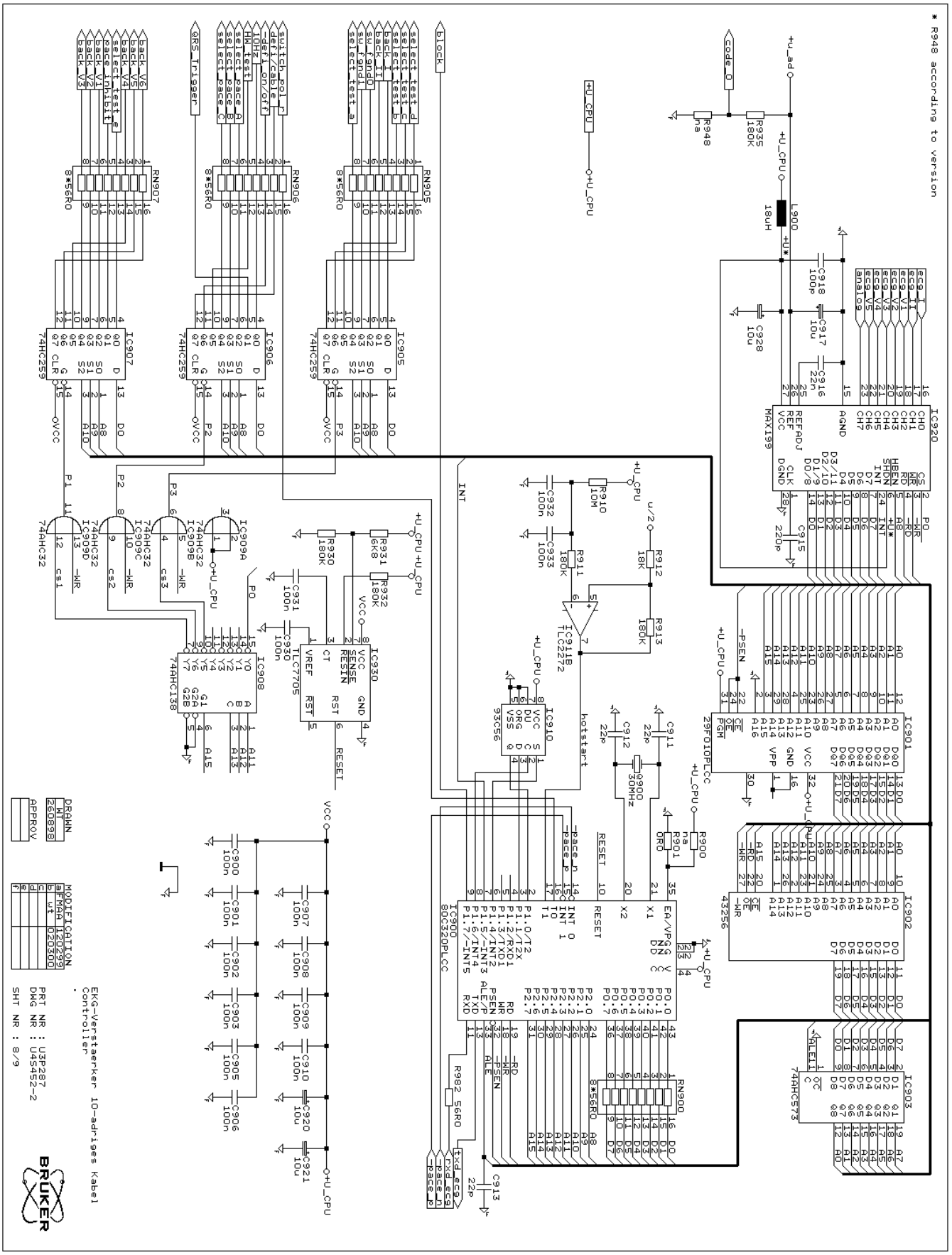
	MODIFICATION
a	FMAN 120299
b	
c	
d	
e	
f	

EKG-Verstaerker 10-adriges Kabel
Amplifier
cable recognition

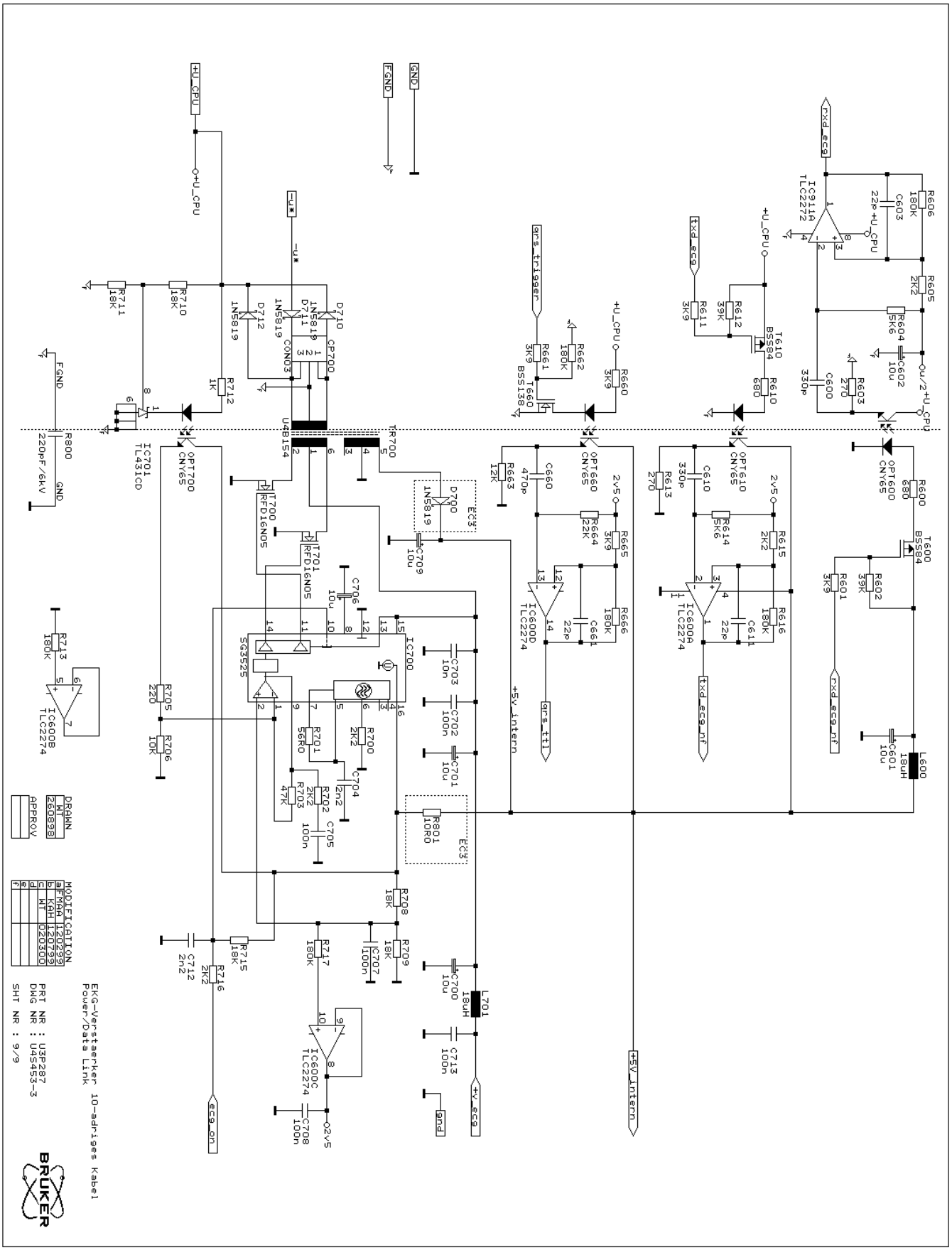
PRT NR : U3P287
DWG NR : U4545I-1
SHT NR : 7/9

BRUKER

8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS



8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS




* = pas implanter / not mounted
U3P287-2
IC982
IC930
OPT660
OPT610
OPT600
OPT700
TR700
CP2
DEFIGARD 501
Amplificateur ECG 12 voies
ECG amplifier 12 channel
ART : U53287
PRT : U3P287-2
DGN : U4L287-2
SHT : 1/1
BRUKER MEDICAL

8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS

COMPONENT LIST OF TWELVE-LEAD ECG AMPLIFIER PCB

1.1 U3P287-2

POSITION	ITEM	DESCRIPTION	MANUFACTURER
C1	45051	CAPA CHIP 1206 2.2N 50V NPO 1%	VITRAM
C100	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C110	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C111	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C112	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C115	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C116	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C117	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C130	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C140	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C141	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C142	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C145	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C146	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C147	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C2	45051	CAPA CHIP 1206 2.2N 50V NPO 1%	VITRAM
C200	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C210	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C211	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C212	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C215	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C216	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C217	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C230	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C240	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C241	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C242	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C245	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C246	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C247	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C260	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C270	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C271	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C272	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C275	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C276	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C277	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C3	45051	CAPA CHIP 1206 2.2N 50V NPO 1%	VITRAM
C30	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C310	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C311	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C312	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C320	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C321	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C322	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C330	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C331	20990	CAPA SMD 1206 100P 50V 5% NPO	VITRAM
C335	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C336	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C35	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM

C4	45051	CAPA CHIP 1206 2.2N 50V NPO 1%	VITRAM
C40	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C400	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C410	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C411	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C412	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C415	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C416	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C417	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C430	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C440	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C441	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C442	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C445	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C446	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C447	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C460	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C470	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C471	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C472	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C475	22172	CAPA SMD 2220 1U 63V 20% Z5U	VITRAM
C476	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C477	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C48	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C49	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C5	45051	CAPA CHIP 1206 2.2N 50V NPO 1%	VITRAM
C50	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C500	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C501	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C51	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C510	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C511	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C52	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C53	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C6	45051	CAPA CHIP 1206 2.2N 50V NPO 1%	VITRAM
C600	20996	CAPA SMD 1206 330P 50V 5% NPO	VITRAM
C601	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C602	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C603	20983	CAPA SMD 1206 27P 50V 5% NPO	VITRAM
C610	20996	CAPA SMD 1206 330P 50V 5% NPO	VITRAM
C611	20983	CAPA SMD 1206 27P 50V 5% NPO	VITRAM
C660	20998	CAPA SMD 1206 470P 50V 5% NPO	VITRAM
C661	20983	CAPA SMD 1206 27P 50V 5% NPO	VITRAM
C7	45051	CAPA CHIP 1206 2.2N 50V NPO 1%	VITRAM
C700	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C701	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C702	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C703	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C704	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C705	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C706	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C707	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C708	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C709	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C710	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C711	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C712	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C713	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C715	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN

C716	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C8	45051	CAPA CHIP 1206 2.2N 50V NPO 1%	VITRAM
C9	45051	CAPA CHIP 1206 2.2N 50V NPO 1%	VITRAM
C900	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C901	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C902	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C903	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C905	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C906	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C907	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C908	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C909	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C910	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C911	20983	CAPA SMD 1206 27P 50V 5% NPO	VITRAM
C912	20983	CAPA SMD 1206 27P 50V 5% NPO	VITRAM
C913	20983	CAPA SMD 1206 27P 50V 5% NPO	VITRAM
C915	20994	CAPA SMD 1206 220P 50V 5% NPO	VITRAM
C916	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C917	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C918	20990	CAPA SMD 1206 100P 50V 5% NPO	VITRAM
C920	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C921	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C928	65496	CAPA ELECT TANTAL SMD 10U 25V	SIEMEN
C930	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C931	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C932	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C933	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
CP1	72998	CN M 13 D PRT	JST
CP2	84306	CN M 10 S PC	LUMBER
CP3	84306	CN M 10 S PC	LUMBER
CP700	4384	CN M 3 D PRT BARSIL H6.7MM	AMP
D300	69251	DIODE SMD 1206 1% 1N4148	BOURNS
D301	69251	DIODE SMD 1206 1% 1N4148	BOURNS
D302	69251	DIODE SMD 1206 1% 1N4148	BOURNS
D710	51589	DIODE SMD PRLL5819 SOD87	PHILIP
D711	51589	DIODE SMD PRLL5819 SOD87	PHILIP
D712	51589	DIODE SMD PRLL5819 SOD87	PHILIP
E1	65947	SPARKER FUSE 230V	SIEMEN
E2	65947	SPARKER FUSE 230V	SIEMEN
E3	65947	SPARKER FUSE 230V	SIEMEN
E4	65947	SPARKER FUSE 230V	SIEMEN
E5	65947	SPARKER FUSE 230V	SIEMEN
E6	65947	SPARKER FUSE 230V	SIEMEN
E7	65947	SPARKER FUSE 230V	SIEMEN
E8	65947	SPARKER FUSE 230V	SIEMEN
E9	65947	SPARKER FUSE 230V	SIEMEN
IC1	51685	IC 4053/MUX CD4053BCM SO16	FAIRCH
IC10	69964	IC 2274 /TLC2274CD SMD SO D	TI
IC100	69964	IC 2274 /TLC2274CD SMD SO D	TI
IC102	69964	IC 2274 /TLC2274CD SMD SO D	TI
IC11	69964	IC 2274 /TLC2274CD SMD SO D	TI
IC110	51685	IC 4053/MUX CD4053BCM SO16	FAIRCH
IC12	69964	IC 2274 /TLC2274CD SMD SO D	TI
IC140	51685	IC 4053/MUX CD4053BCM SO16	FAIRCH
IC2	51685	IC 4053/MUX CD4053BCM SO16	FAIRCH
IC202	69964	IC 2274 /TLC2274CD SMD SO D	TI
IC210	51685	IC 4053/MUX CD4053BCM SO16	FAIRCH
IC240	51685	IC 4053/MUX CD4053BCM SO16	FAIRCH
IC260	69964	IC 2274 /TLC2274CD SMD SO D	TI

IC262	69964	IC 2274 /TLC2274CD SMD SO D	TI
IC270	51685	IC 4053/MUX CD4053BCM SO16	FAIRCH
IC3	51685	IC 4053/MUX CD4053BCM SO16	FAIRCH
IC30	69964	IC 2274 /TLC2274CD SMD SO D	TI
IC300	51685	IC 4053/MUX CD4053BCM SO16	FAIRCH
IC301	51953	IC 4051/MUX HEF4051BT SO16	PHILIP
IC302	69964	IC 2274 /TLC2274CD SMD SO D	TI
IC303	51676	IC 4538/CD HEF4538BT SO16 SMD	PHILIP
IC4	51953	IC 4051/MUX HEF4051BT SO16	PHILIP
IC410	51685	IC 4053/MUX CD4053BCM SO16	FAIRCH
IC432	69964	IC 2274 /TLC2274CD SMD SO D	TI
IC440	51685	IC 4053/MUX CD4053BCM SO16	FAIRCH
IC470	51685	IC 4053/MUX CD4053BCM SO16	FAIRCH
IC5	51953	IC 4051/MUX HEF4051BT SO16	PHILIP
IC500	69958	IC 2272 /TLC2272CD SMD SO8	TI
IC6	51953	IC 4051/MUX HEF4051BT SO16	PHILIP
IC600	69964	IC 2274 /TLC2274CD SMD SO D	TI
IC700	84126	IC 3525 /SG3525AP SO16	MOTORO
IC701	51832	IC 431/VREF TL431CD SO8 SMD	TI
IC900	69968	IC 80320 /DS80C320 PLCC44	DALLAS
IC901	U06064	PG ODAM EPROM ECG PROGR.	EMED
IC902	51531	IC 43256/SRAM SOP 28 SMD	NEC
IC903	69963	IC 74573 /SN74AHC573 SMD TSSOP	TI
IC905	51921	IC 74259/74HC259 SO16 SMD	TI
IC906	51921	IC 74259/74HC259 SO16 SMD	TI
IC907	51921	IC 74259/74HC259 SO16 SMD	TI
IC908	69973	IC 74138 /SN74AHC138 SMD TSSOP	TI
IC909	69965	IC 7432 /SN74AHC32 SMD TSSOP14	TI
IC910	69967	IC 9356 /M93C56 SO8	STM
IC911	69958	IC 2272 /TLC2272CD SMD SO8	TI
IC920	69962	IC 199 /MAX199 SMD SSOP28	MAXIM
IC930	69961	IC 7705 /TLC7705 SMD SO D	TI
L1	14468	SELF 18UH	STETTN
L2	21352	RES SMD 0 1% 0.25W 1206	BOURNS
L600	14468	SELF 18UH	STETTN
L701	21352	RES SMD 0 1% 0.25W 1206	BOURNS
L900	14468	SELF 18UH	STETTN
OPT600	84349	OPTO KOP CNY65	TEMIC
OPT610	84349	OPTO KOP CNY65	TEMIC
OPT660	84349	OPTO KOP CNY65	TEMIC
OPT700	84349	OPTO KOP CNY65	TEMIC
PRT	U07287	ECG AMP. 12 CHANEL PCB	POLYTR
Q900	84000	QUARTZ 30MHZ HC49/4H16PF 50PPM	IQD
R1	67014	99 RES MET 0414 1% 1W 120K	BEYSCH
R10	1035	RES MET 121K 1% 0.6W 50PPM	DRALOR
R100	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R101	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R102	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R103	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R104	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R105	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R11	1035	RES MET 121K 1% 0.6W 50PPM	DRALOR
R110	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R111	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R112	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R113	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R114	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R115	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R116	21344	RES SMD 562K 1% 0.25W 1206	BOURNS

R117	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R118	84137	RES CHIP 1206 1% 0.25W 34.8K	BOURNS
R119	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R12	1035	RES MET 121K 1% 0.6W 50PPM	DRALOR
R13	1035	RES MET 121K 1% 0.6W 50PPM	DRALOR
R130	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R131	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R132	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R133	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R134	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R135	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R14	1035	RES MET 121K 1% 0.6W 50PPM	DRALOR
R140	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R141	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R142	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R143	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R144	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R145	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R146	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R147	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R148	84137	RES CHIP 1206 1% 0.25W 34.8K	BOURNS
R149	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R15	1035	RES MET 121K 1% 0.6W 50PPM	DRALOR
R16	1035	RES MET 121K 1% 0.6W 50PPM	DRALOR
R17	1035	RES MET 121K 1% 0.6W 50PPM	DRALOR
R18	1035	RES MET 121K 1% 0.6W 50PPM	DRALOR
R19	1035	RES MET 121K 1% 0.6W 50PPM	DRALOR
R2	67014	99 RES MET 0414 1% 1W 120K	BEYSCH
R200	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R201	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R202	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R203	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R204	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R205	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R21	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R210	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R211	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R212	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R213	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R214	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R215	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R216	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R217	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R218	84137	RES CHIP 1206 1% 0.25W 34.8K	BOURNS
R219	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R22	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R23	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R230	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R231	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R232	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R233	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R234	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R235	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R24	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R240	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R241	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R242	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R243	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R244	21338	RES SMD 182K 1% 0.25W 1206	BOURNS

R245	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R246	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R247	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R248	84137	RES CHIP 1206 1% 0.25W 34.8K	BOURNS
R249	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R25	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R26	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R260	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R261	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R262	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R263	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R264	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R265	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R27	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R270	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R271	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R272	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R273	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R274	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R275	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R276	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R277	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R278	84137	RES CHIP 1206 1% 0.25W 34.8K	BOURNS
R279	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R28	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R29	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R3	67014	99 RES MET 0414 1% 1W 120K	BEYSCH
R30	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R300	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R301	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R31	21334	RES SMD 82.5K 1% 0.25W 1206	BOURNS
R310	21333	RES SMD 68.1K 1% 0.25W 1206	BOURNS
R311	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R312	20734	RES SMD 681 1% 0.25W 1206	BOURNS
R313	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R32	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R320	21333	RES SMD 68.1K 1% 0.25W 1206	BOURNS
R321	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R322	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R323	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R33	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R330	21333	RES SMD 68.1K 1% 0.25W 1206	BOURNS
R331	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R332	21351	RES SMD 2.21M 1% 0.25W 1206	BOURNS
R333	21351	RES SMD 2.21M 1% 0.25W 1206	BOURNS
R334	21351	RES SMD 2.21M 1% 0.25W 1206	BOURNS
R335	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R336	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R337	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R338	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R339	53699	RES SMD 47.5K 1% 0.25W 1206	BOURNS
R34	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R340	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R36	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R37	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R38	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R4	67014	99 RES MET 0414 1% 1W 120K	BEYSCH
R40	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R400	20750	RES SMD 10K 1% 0.25W 1206	BOURNS

R401	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R402	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R403	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R404	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R405	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R41	21333	RES SMD 68.1K 1% 0.25W 1206	BOURNS
R410	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R411	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R412	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R413	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R414	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R415	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R416	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R417	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R418	84137	RES CHIP 1206 1% 0.25W 34.8K	BOURNS
R419	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R42	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R43	20730	RES SMD 332 1% 0.25W 1206	BOURNS
R430	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R431	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R432	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R433	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R434	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R435	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R44	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R440	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R441	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R442	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R443	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R444	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R445	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R446	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R447	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R448	84137	RES CHIP 1206 1% 0.25W 34.8K	BOURNS
R449	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R45	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R46	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R460	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R461	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R462	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R463	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R464	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R465	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R470	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R471	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R472	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R473	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R474	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R475	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R476	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R477	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R478	84137	RES CHIP 1206 1% 0.25W 34.8K	BOURNS
R479	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R48	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R49	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R5	67014	99 RES MET 0414 1% 1W 120K	BEYSCH
R50	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R500	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R501	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS

R502	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R504	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R505	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R51	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R510	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R511	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R512	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R514	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R515	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R52	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R53	69298	RES CHIP 1206 1% 3.9M	BOURNS
R56	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R57	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R58	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R6	67014	99 RES MET 0414 1% 1W 120K	BEYSCH
R60	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R600	20734	RES SMD 681 1% 0.25W 1206	BOURNS
R601	20744	RES SMD 3.92K 1% 0.25W 1206	BOURNS
R602	21330	RES SMD 39.2K 1% 0.25W 1206	BOURNS
R603	53689	RES SMD 274 1% 0.25W 1206	BOURNS
R604	20746	RES SMD 5.62K 1% 0.25W 1206	BOURNS
R605	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R606	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R61	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R610	20734	RES SMD 681 1% 0.25W 1206	BOURNS
R611	20744	RES SMD 3.92K 1% 0.25W 1206	BOURNS
R612	21330	RES SMD 39.2K 1% 0.25W 1206	BOURNS
R613	53689	RES SMD 274 1% 0.25W 1206	BOURNS
R614	20746	RES SMD 5.62K 1% 0.25W 1206	BOURNS
R615	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R616	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R62	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R63	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R64	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R65	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R66	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R660	20744	RES SMD 3.92K 1% 0.25W 1206	BOURNS
R661	20744	RES SMD 3.92K 1% 0.25W 1206	BOURNS
R662	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R663	21324	RES SMD 12.1K 1% 0.25W 1206	BOURNS
R664	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R665	20744	RES SMD 3.92K 1% 0.25W 1206	BOURNS
R666	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R67	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R68	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R69	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R7	67014	99 RES MET 0414 1% 1W 120K	BEYSCH
R70	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R700	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R701	20720	RES SMD 56.2 1% 0.25W 1206	BOURNS
R702	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R703	53699	RES SMD 47.5K 1% 0.25W 1206	BOURNS
R705	20728	RES SMD 221 1% 0.25W 1206	BOURNS
R706	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R708	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R709	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R71	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R710	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R711	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS

R712	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R713	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R715	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R716	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R717	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R74	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R75	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R76	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R77	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R78	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R8	67014	99 RES MET 0414 1% 1W 120K	BEYSCH
R800	72651	CAPA CERDI 220PF 6KV R12.5	ROEDER
R801	986	RES MET 10 1% 0.6W 50PPM	DRALOR
R9	67014	99 RES MET 0414 1% 1W 120K	BEYSCH
R901	21352	RES SMD 0 1% 0.25W 1206	BOURNS
R910	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R911	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R912	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R913	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R930	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R931	20747	RES SMD 6.81K 1% 0.25W 1206	BOURNS
R932	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R935	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R937	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R943	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R948	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R982	20720	RES SMD 56.2 1% 0.25W 1206	BOURNS
RN900	84061	RES NET SOP16 8X56 2%	BOURNS
RN905	84061	RES NET SOP16 8X56 2%	BOURNS
RN906	84061	RES NET SOP16 8X56 2%	BOURNS
RN907	84061	RES NET SOP16 8X56 2%	BOURNS
SO901	69969	IC SOCKEL PLCC32 SMD	NUGENT
T600	51471	TRANS SMD BSS84 SOT23	SIEMEN
T610	51471	TRANS SMD BSS84 SOT23	SIEMEN
T660	51470	TRANS SMD BSS138 SOT23	SIEMEN
T70	51470	TRANS SMD BSS138 SOT23	SIEMEN
T700	68375	TRANS RFD16N05 TO-251AA	HARRIS
T701	68375	TRANS RFD16N05 TO-251AA	HARRIS
T71	51470	TRANS SMD BSS138 SOT23	SIEMEN
TR700	U21156	CORE FERRITE MOUNT.U4B156	EMED

8.9. DEFIBRILLATION ECG PREAMP PRINTED CIRCUIT BOARD

Article no.: **W141 1901**

Description: **DEFIBRILLATION ECG PREAMP BOARD**

Reference: **W4P14 1691A or**
W4P14 1691B

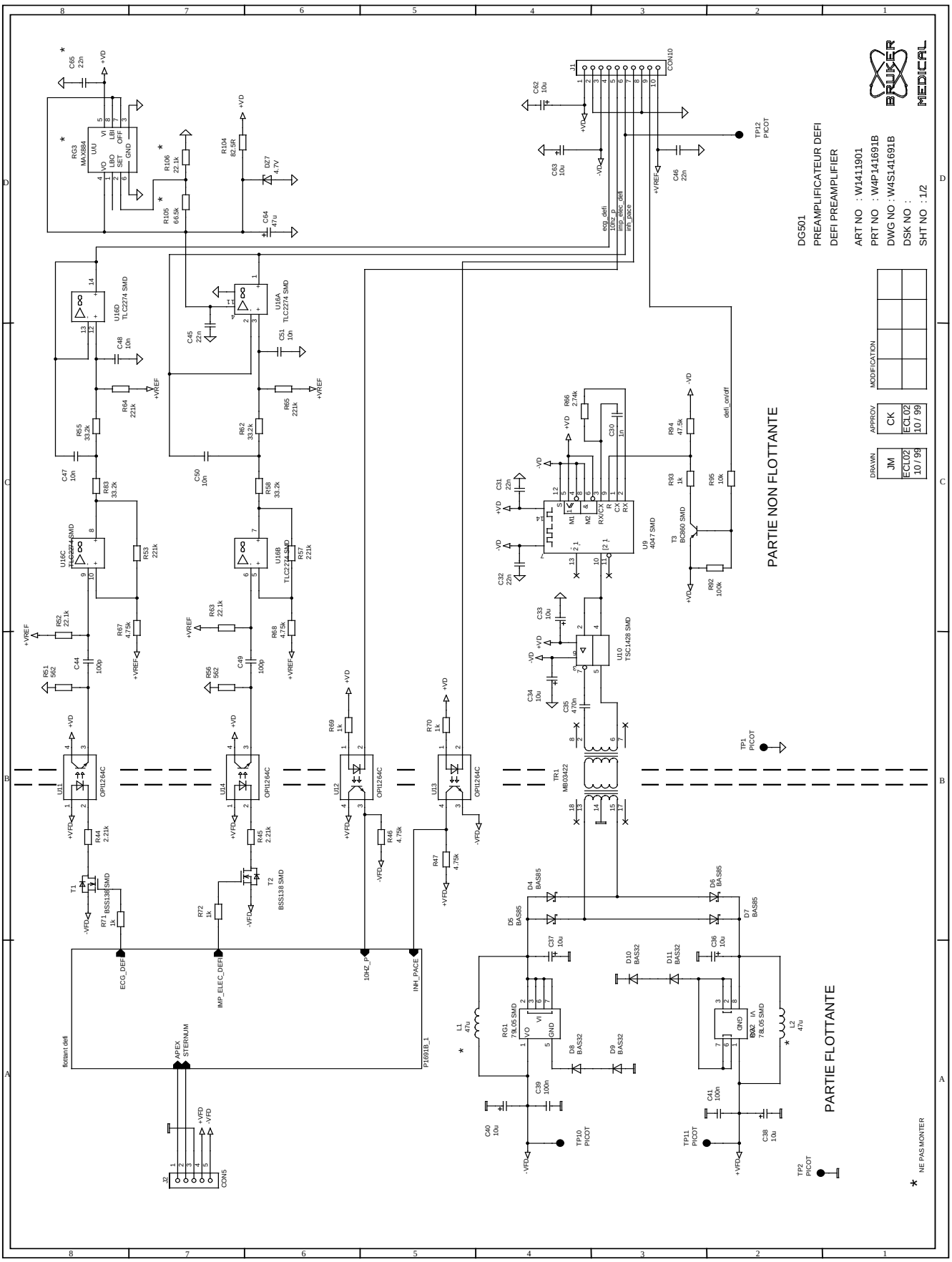
Adjustments:

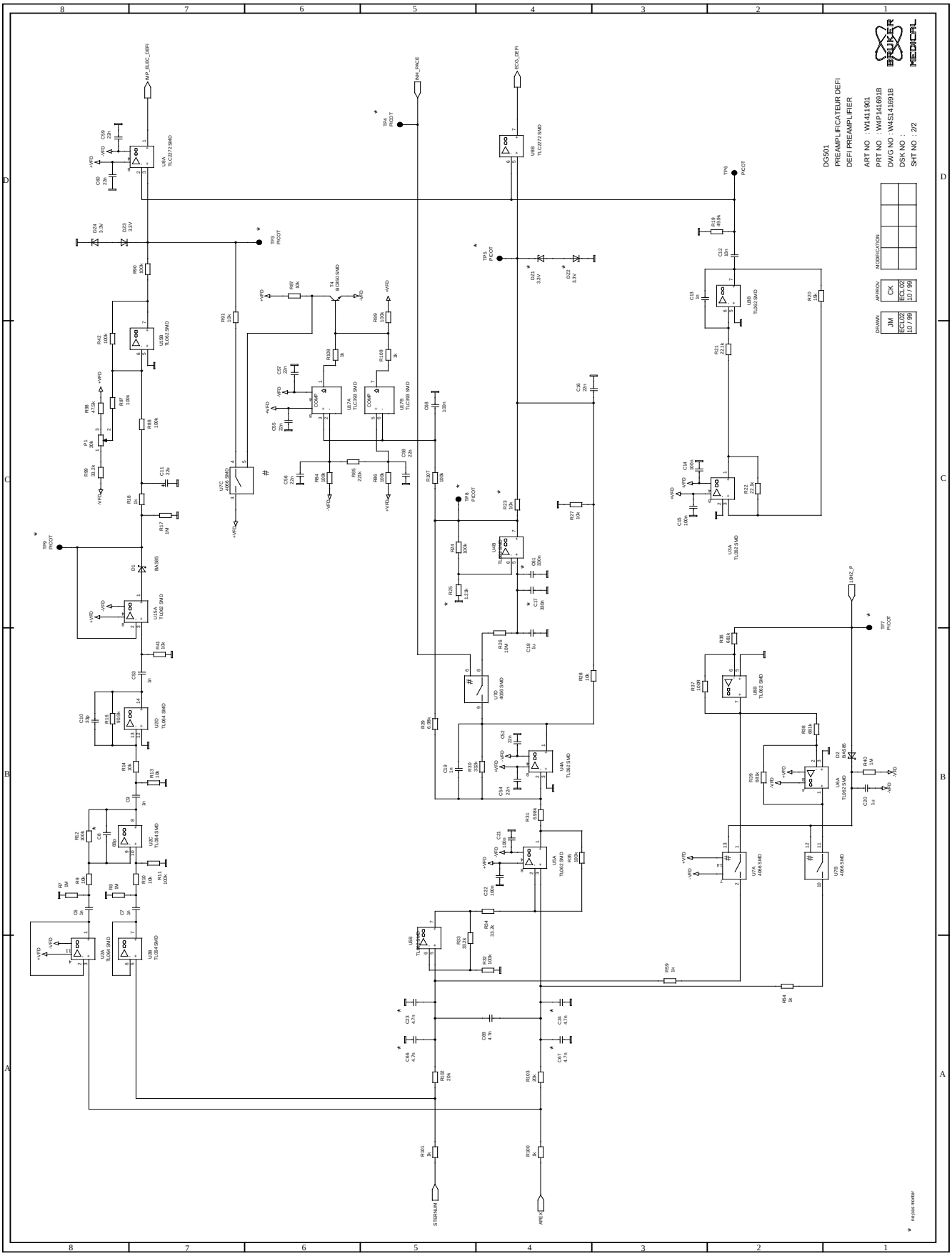
The Defibrillator ECG preamplifier PCB requires one adjustment:
1. setting the patient impedance measurement signal (P1)

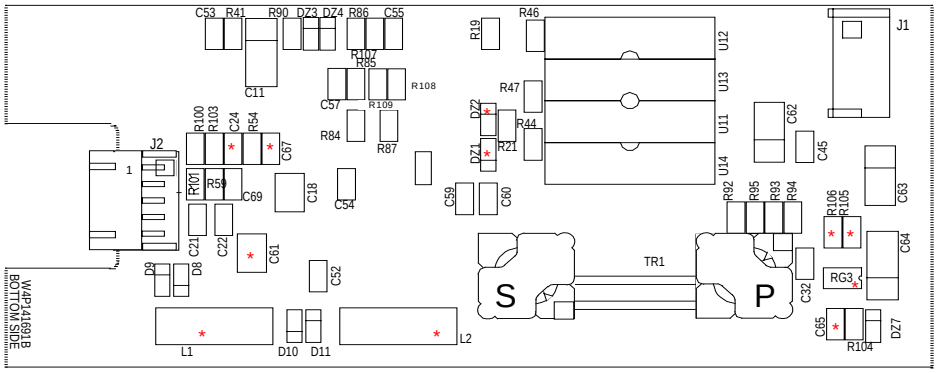
Adjustment	Measuring apparatus	Measuring point	Adjustable	Settings and tolerances	Notes
Patient impedance measurement signal	VDC digital multimeter	between pin TP1 (GND) and lug 6 of J10	P1	If Z = 25 Ω the measured voltage must be: 1.660 V ± 0.050 V	The 25-Ω resistor is connected to the adhesive electrode connector.

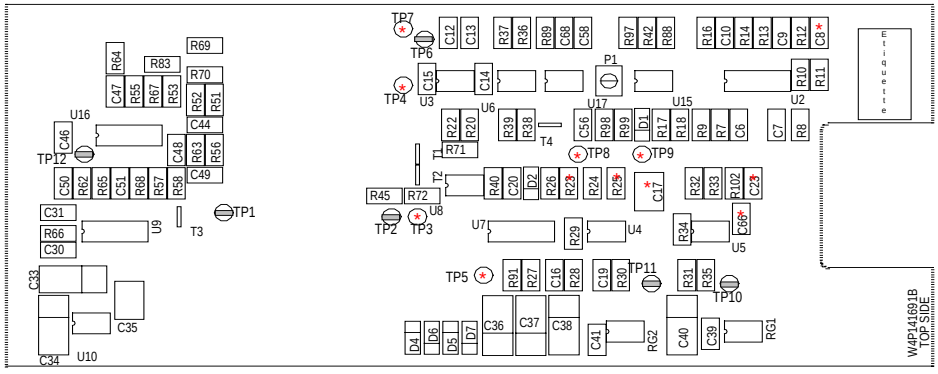
Caution: If the defibrillator ECG preamp board or the defibrillator preamp protection board is replaced, this adjustment must be repeated.

8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS




DG501
PREAMPLIFICATEUR DEFI
DEFI PREAMPLIFIER
ART NO : W1411901
PRT NO : W4P141691B
DWG NO : W4S141691B
DSK NO :
SHT NO : 2/2
BRUKER MEDICAL
MODIFICATION
APPROV
CK
EC1.02
10 / 99
DRAWN
JM
EC102
10 / 99
AMP_ELEC_DEFI
ECG_DEFI
PACE_IN
STERNUM
APEX
LOAD_P
* no pass monter





DEFIGARD 501.
PREAMPLIFICATEUR DEFI
DEFI PREAMPLIFIER

DRAWN	APPROV	MODIFICATION
ECL2	ECL2	
10/99	10/99	

ART NO : W1411901
PRT NO : W4P141691B
DWG NO : W4L141691B
DSK NO :
SHT NO : 1/1

BRUKER MEDICAL

* = pas monté

8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS

COMPONENT LIST OF TWELVE-LEAD ECG AMPLIFIER PCB

W4P14 1691B

POSITION	ITEM	DESCRIPTION	MANUFACTURER
C10	20984	CAPA SMD 1206 33P 50V 5% NPO	VITRAM
C11	51557	CAPA SMD TANTAL 22U 20V 20%	SPRAGU
C12	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C13	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C14	72502	CAPA SMD 1206 100N 50V 5% X7R	VITRAM
C15	72502	CAPA SMD 1206 100N 50V 5% X7R	VITRAM
C16	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C18	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C19	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C20	72660	CAPA SMD 1206 1U 16V +80/-20%	TDK
C21	72502	CAPA SMD 1206 100N 50V 5% X7R	VITRAM
C22	72502	CAPA SMD 1206 100N 50V 5% X7R	VITRAM
C30	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C31	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C32	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C33	51559	CAPA SMD TANTAL 10U 16V 20%	SPRAGU
C34	51559	CAPA SMD TANTAL 10U 16V 20%	SPRAGU
C35	22597	CAPA SMD 1812 470N 50V 20% X7R	VITRAM
C36	51559	CAPA SMD TANTAL 10U 16V 20%	SPRAGU
C37	51559	CAPA SMD TANTAL 10U 16V 20%	SPRAGU
C38	51559	CAPA SMD TANTAL 10U 16V 20%	SPRAGU
C39	72502	CAPA SMD 1206 100N 50V 5% X7R	VITRAM
C40	51559	CAPA SMD TANTAL 10U 16V 20%	SPRAGU
C41	72502	CAPA SMD 1206 100N 50V 5% X7R	VITRAM
C44	20990	CAPA SMD 1206 100P 50V 5% NPO	VITRAM
C45	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C46	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C47	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C48	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C49	20990	CAPA SMD 1206 100P 50V 5% NPO	VITRAM
C50	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C51	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C52	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C53	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C54	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C55	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C56	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C57	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C58	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C59	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C6	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C60	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C62	51556	CAPA SMD TANTAL 47U 16V 20%	SPRAGU
C63	51556	CAPA SMD TANTAL 47U 16V 20%	SPRAGU
C64	51556	CAPA SMD TANTAL 47U 16V 20%	SPRAGU
C68	72502	CAPA SMD 1206 100N 50V 5% X7R	VITRAM
C69	21010	CAPA SMD 1206 4.7N 50V 10% X7R	VITRAM
C7	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C9	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
D1	51329	DIODE SMD BAS85 SOD80	PHILIP
D10	22029	DIODE SMD BAS32L SOD80	PHILIP

D11	22029	DIODE SMD BAS32L SOD80	PHILIP
D2	51329	DIODE SMD BAS85 SOD80	PHILIP
D4	51329	DIODE SMD BAS85 SOD80	PHILIP
D5	51329	DIODE SMD BAS85 SOD80	PHILIP
D6	51329	DIODE SMD BAS85 SOD80	PHILIP
D7	51329	DIODE SMD BAS85 SOD80	PHILIP
D8	22029	DIODE SMD BAS32L SOD80	PHILIP
D9	22029	DIODE SMD BAS32L SOD80	PHILIP
DZ3	51945	DIODE Z SMD SOD80 3.3V	PHILIP
DZ4	51945	DIODE Z SMD SOD80 3.3V	PHILIP
DZ7	51772	DIODE Z SMD SOD80 4.7V	PHILIP
J1	84306	CN M 10 S PC	LUMBER
J2	72977	CN M 5 C PRT	JST
P1	51460	RES ADJUST 20K 0.25W 1T SMD	BOURNS
P1691B	W1404663	IC DEF PREAMPLIFIER DG501	WUERTH
R10	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R100	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R101	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R102	33927	RES SMD 20K 1% 0.25W 1206	BOURNS
R103	33927	RES SMD 20K 1% 0.25W 1206	BOURNS
R104	20722	RES SMD 82.5 1% 0.25W 1206	BOURNS
R107	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R108	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R109	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R11	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R12	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R13	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R14	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R16	53697	RES SMD 90.9K 1% 0.25W 1206	BOURNS
R17	21347	RES SMD 1M 1% 0.25W 1206	BOURNS
R18	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R19	51750	RES SMD 49.9K 1% 0.25W 1206	BOURNS
R20	21325	RES SMD 15K 1% 0.25W 1206	BOURNS
R21	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R22	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R24	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R26	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R27	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R28	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R29	51763	RES SMD 6.98K 1% 0.25W 1206	BOURNS
R30	53690	RES SMD 332K 1% 0.25W 1206	BOURNS
R31	51763	RES SMD 6.98K 1% 0.25W 1206	BOURNS
R32	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R33	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R34	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R35	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R36	21345	RES SMD 681K 1% 0.25W 1206	BOURNS
R37	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R38	21345	RES SMD 681K 1% 0.25W 1206	BOURNS
R39	21345	RES SMD 681K 1% 0.25W 1206	BOURNS
R40	21347	RES SMD 1M 1% 0.25W 1206	BOURNS
R41	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R42	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R44	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R45	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R46	20745	RES SMD 4.7K 1% 0.25W 1206	BOURNS
R47	20745	RES SMD 4.7K 1% 0.25W 1206	BOURNS
R51	20733	RES SMD 562 1% 0.25W 1206	BOURNS
R52	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS

R53	21339	RES SMD 221K 1% 0.25W 1206	BOURNS
R54	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R55	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R56	20733	RES SMD 562 1% 0.25W 1206	BOURNS
R57	21339	RES SMD 221K 1% 0.25W 1206	BOURNS
R58	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R59	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R62	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R63	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R64	21339	RES SMD 221K 1% 0.25W 1206	BOURNS
R65	21339	RES SMD 221K 1% 0.25W 1206	BOURNS
R66	20742	RES SMD 2.7K 1% 0.25W 1206	BOURNS
R67	20745	RES SMD 4.7K 1% 0.25W 1206	BOURNS
R68	20745	RES SMD 4.7K 1% 0.25W 1206	BOURNS
R69	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R7	21347	RES SMD 1M 1% 0.25W 1206	BOURNS
R70	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R71	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R72	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R8	21347	RES SMD 1M 1% 0.25W 1206	BOURNS
R83	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R84	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R85	21339	RES SMD 221K 1% 0.25W 1206	BOURNS
R86	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R87	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R88	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R89	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R9	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R90	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R91	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R92	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R93	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R94	53699	RES SMD 47.5K 1% 0.25W 1206	BOURNS
R95	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R97	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R98	53699	RES SMD 47.5K 1% 0.25W 1206	BOURNS
R99	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
RG1	22993	IC 7905/VREG MC79L05ACD SO8	MOTORO
RG2	22504	IC 7805/VREG MC78L05ACD SO8	MOTORO
T1	51470	TRANS SMD BSS138 SOT23	SIEMEN
T2	51470	TRANS SMD BSS138 SOT23	SIEMEN
T3	51777	TRANS SMD BC860C PNP SOT23	SIEMEN
T4	51779	TRANS SMD BC850C NPN SOT23	MOTORO
TP1	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP10	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP11	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP12	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP2	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP6	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TR1	W1402079	TRANS CONVERTER DG2005D	MICROS
U10	51582	IC 1428/DRV TC1428COA SO8 SMD	TELCOM
U11	72268	OPTO COUP OPI1264C	OPTEK
U12	72268	OPTO COUP OPI1264C	OPTEK
U13	72268	OPTO COUP OPI1264C	OPTEK
U14	72268	OPTO COUP OPI1264C	OPTEK
U15	51675	IC 062/OP TL062CD SO8 SMD	TI
U16	72941	IC 2274 /TLC2274ACD SO14	TI
U17	72272	IC 393/OP TLC393CD SO8	TI
U2	51545	IC 064/OP TL064CD SO14 SMD	ST

U3	51675	IC 062/OP TL062CD SO8 SMD	TI
U4	51675	IC 062/OP TL062CD SO8 SMD	TI
U5	51675	IC 062/OP TL062CD SO8 SMD	TI
U6	51675	IC 062/OP TL062CD SO8 SMD	TI
U7	51794	IC 4066/SWI CD4066BM SO14	HARRIS
U8	69958	IC 2272 /TLC2272CD SMD SO8	TI
U9	51796	IC 4047/CD HEF4047BT SO14 SMD	PHILIP

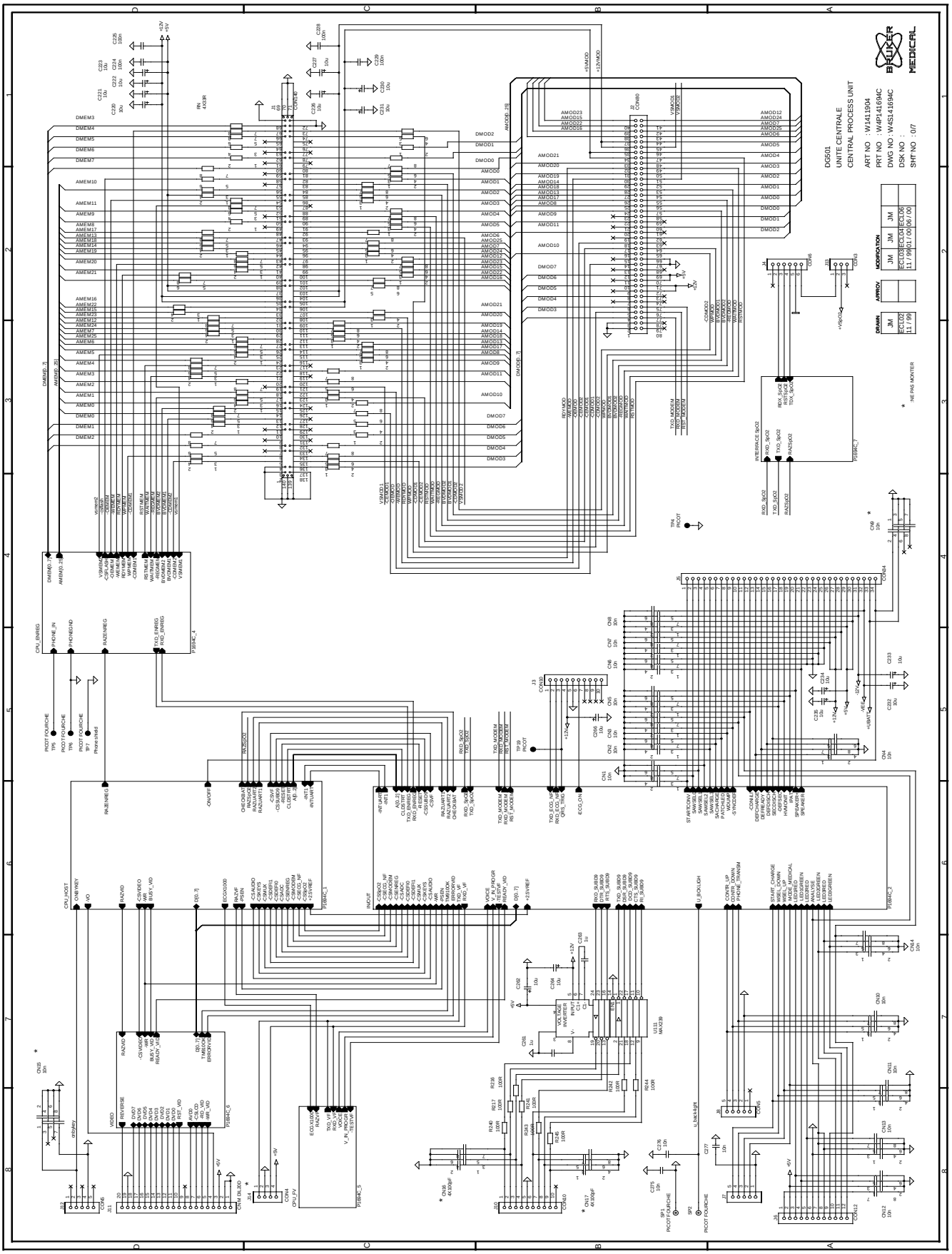
8.10. CENTRAL PROCESSING UNIT PRINTED CIRCUIT BOARD

Article no.: **W141 1904**

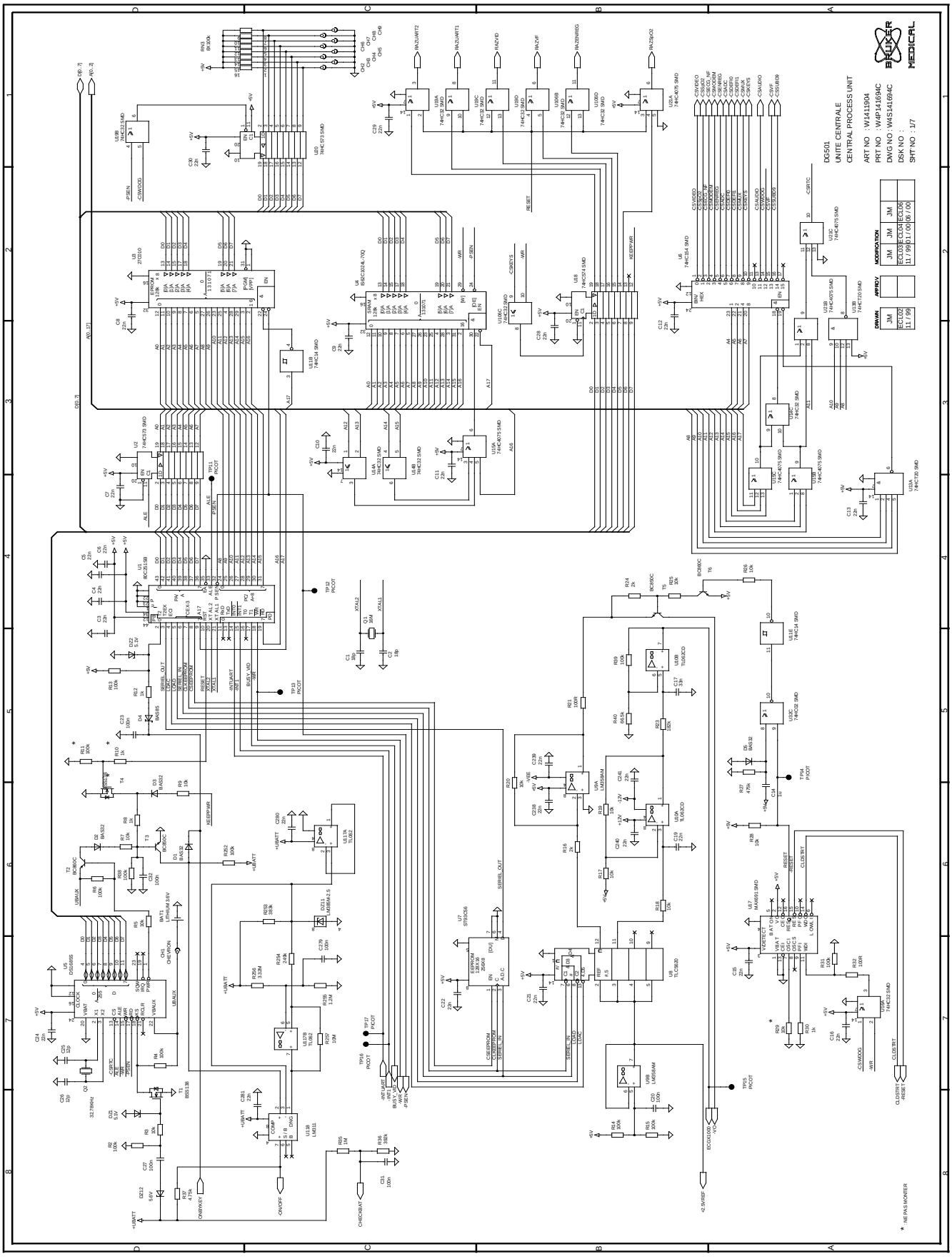
Description: **CPU PCB**

Reference: **W4P14 1694A or**
W4P14 1694C or
W4P14 1694D

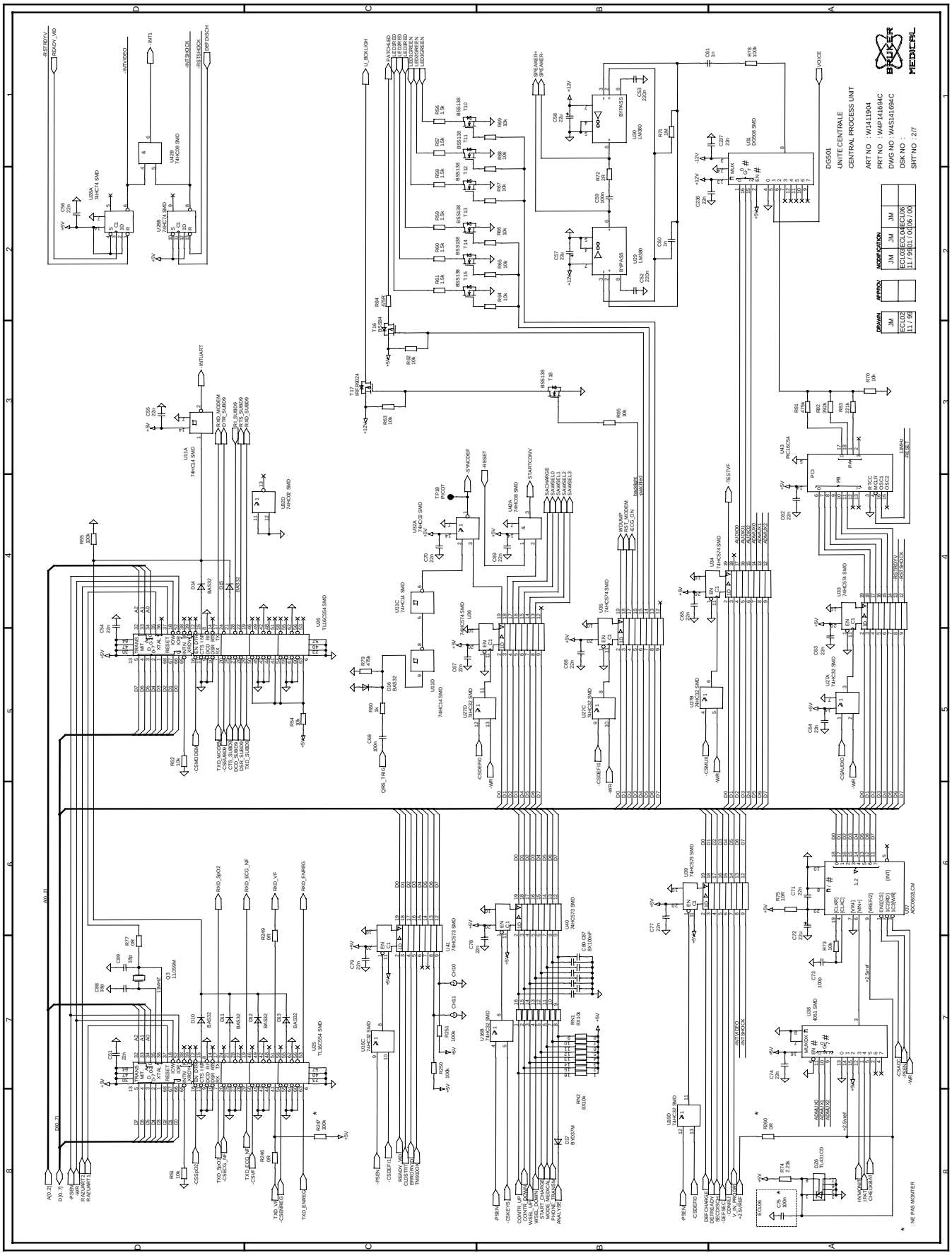
8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS

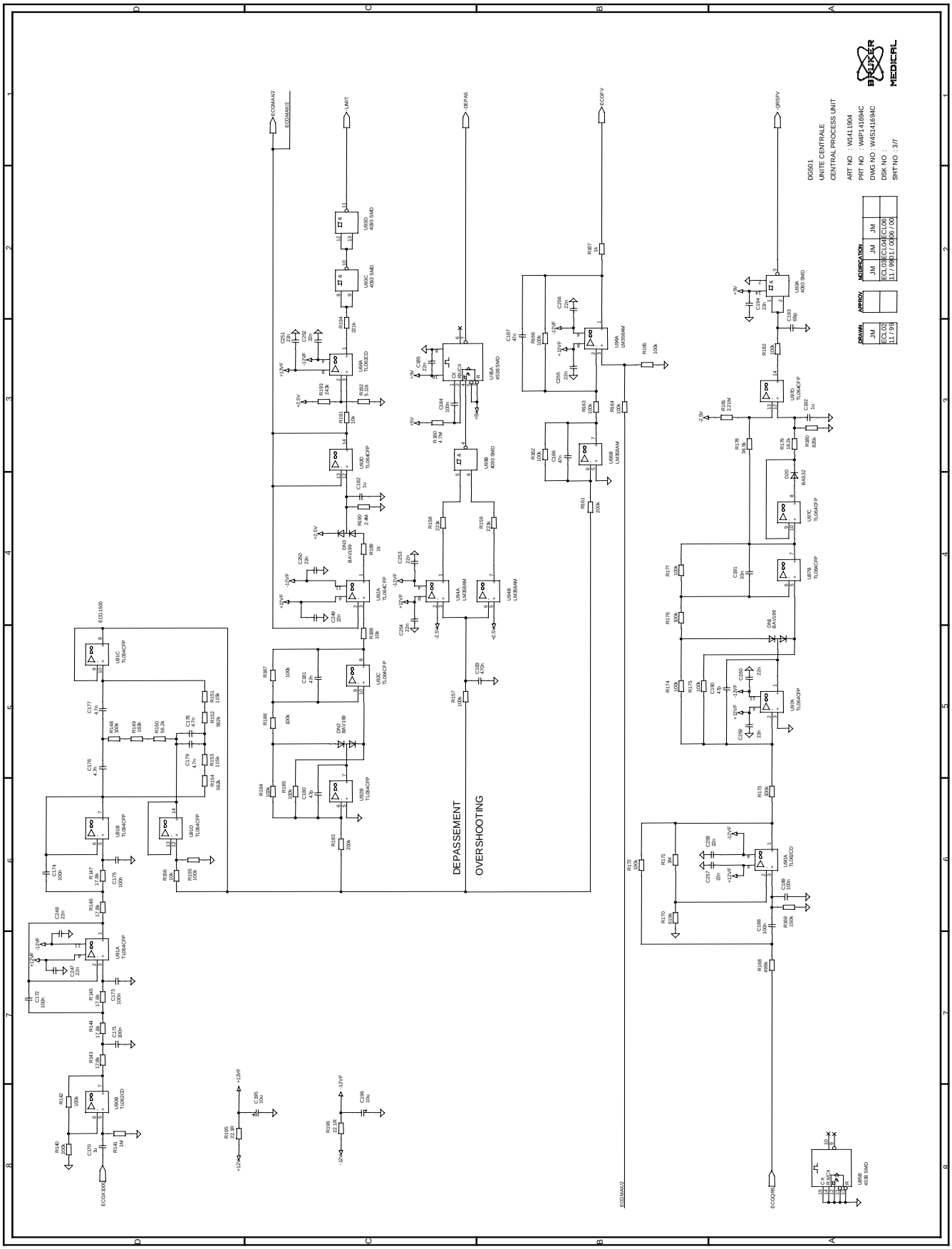


8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS

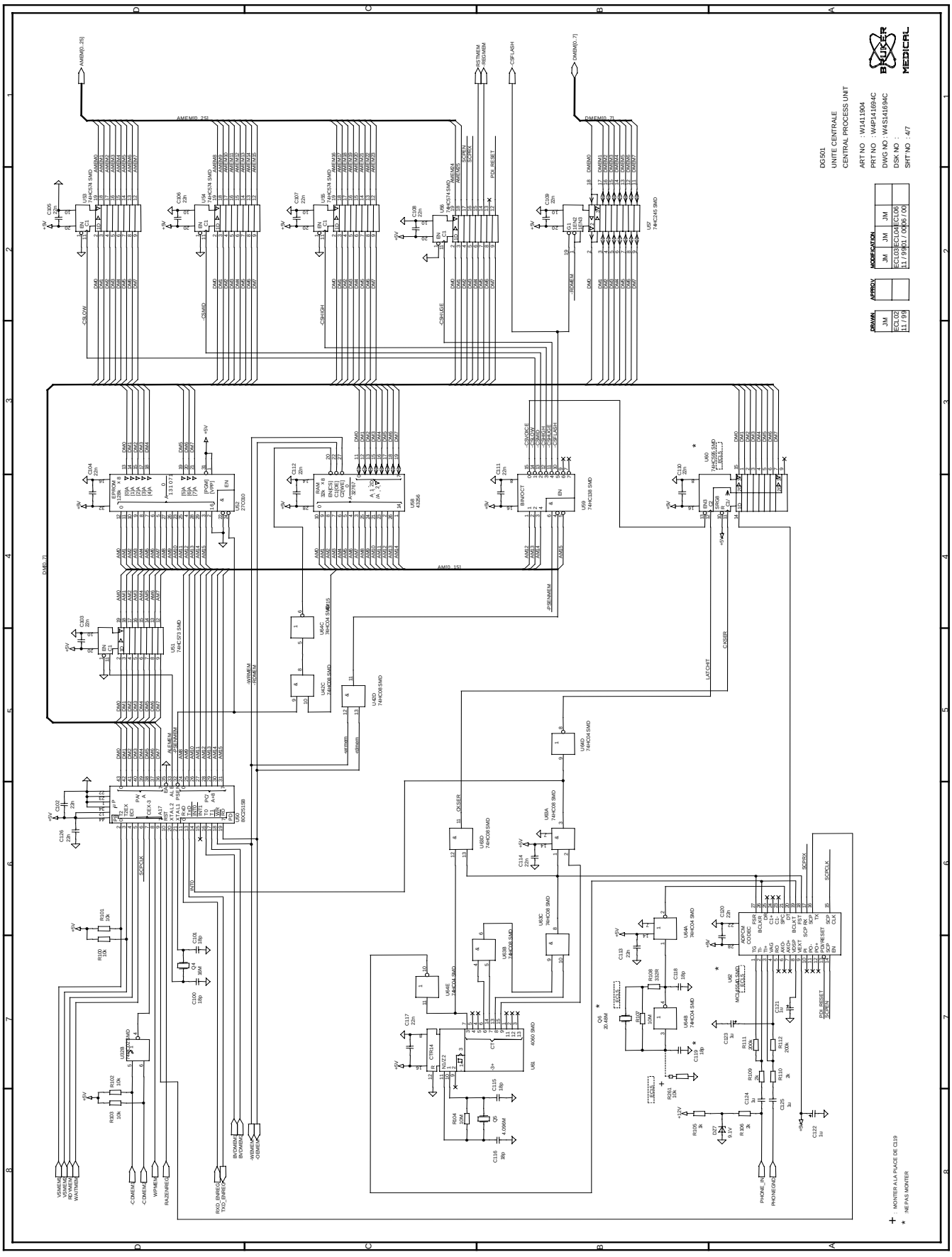


8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS

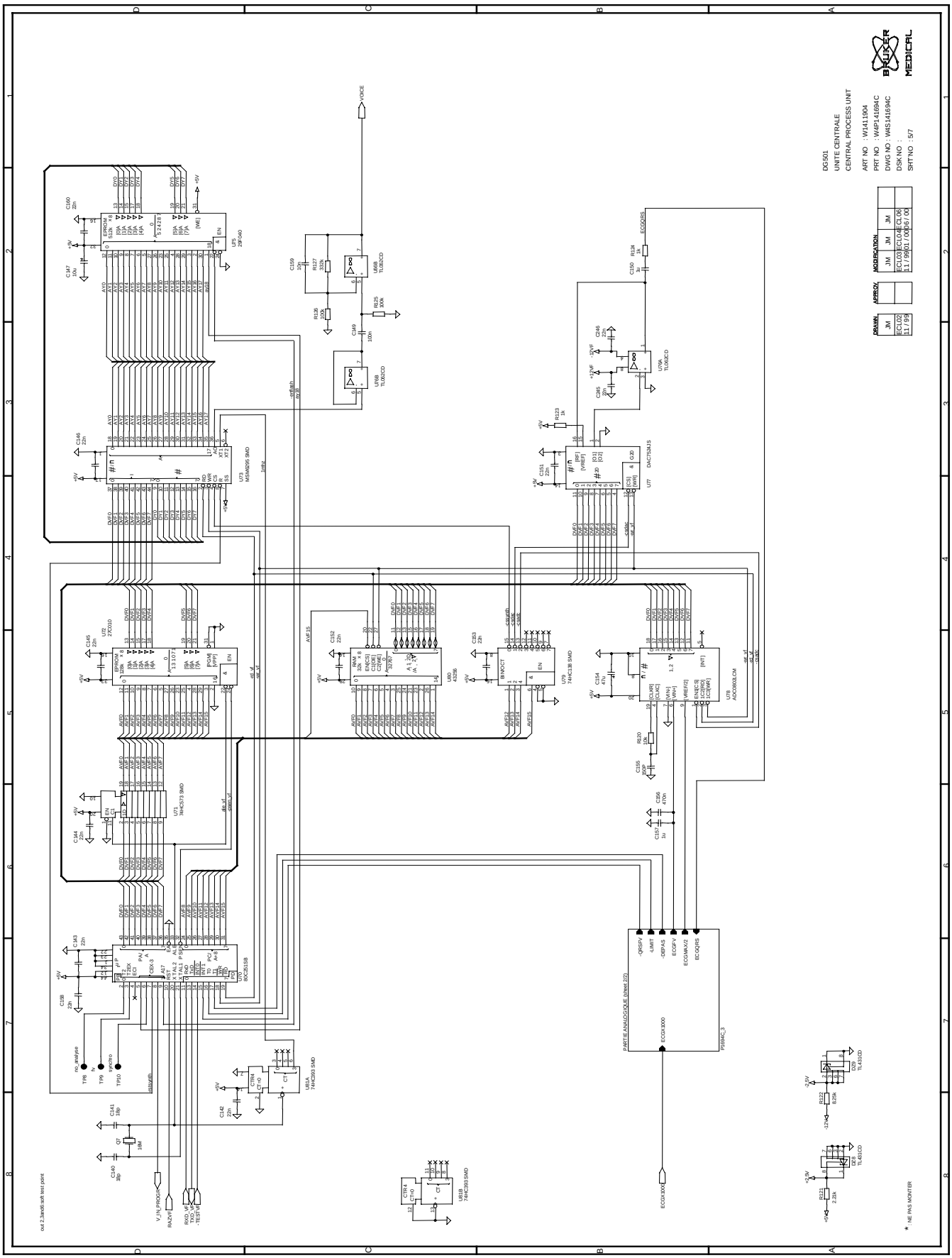


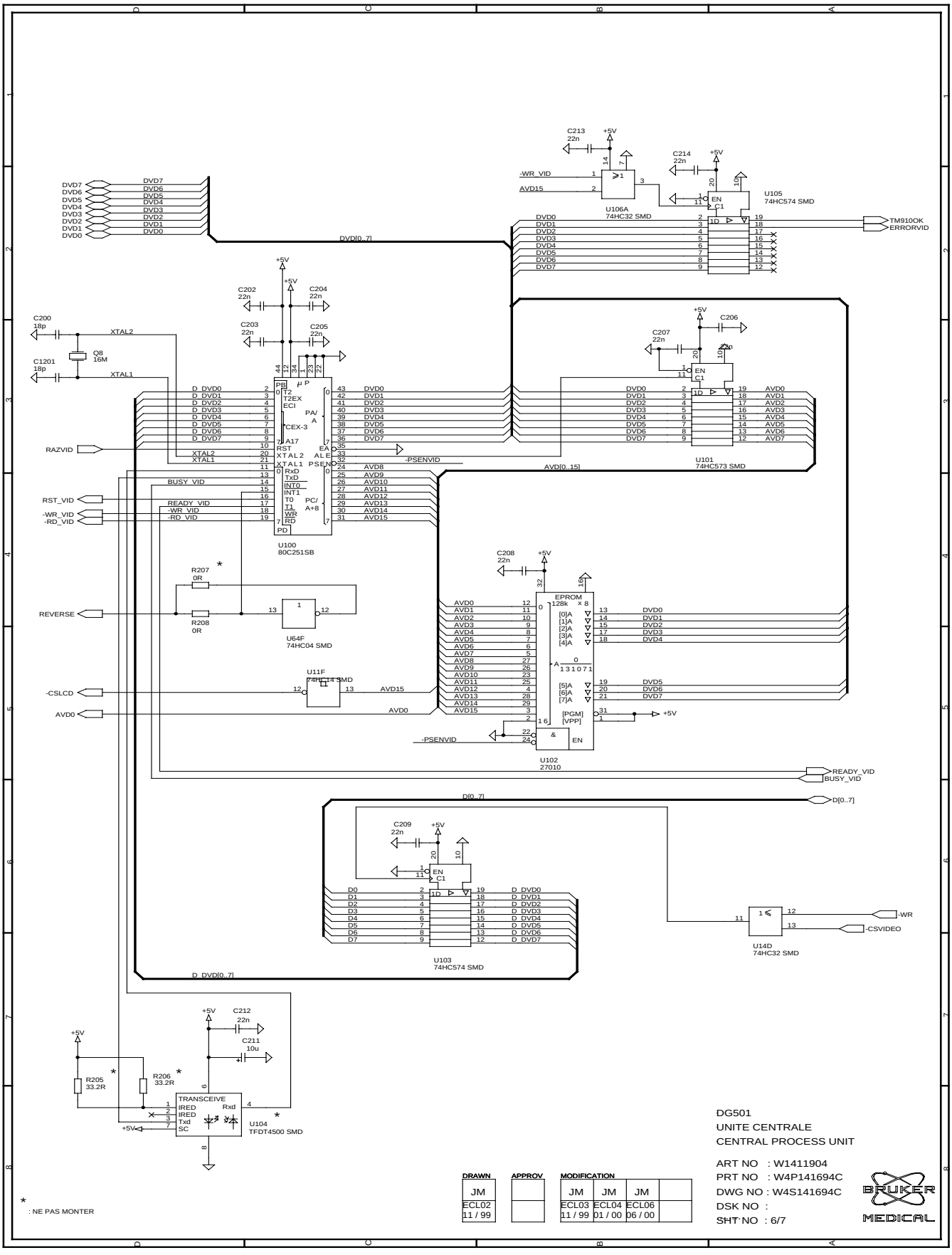

DG501
UNITE CENTRALE
CENTRAL PROCESS UNIT
ART NO : W1411904
PRT NO : WP141694C
DWG NO : WAS141694C
DSK NO :
SHT NO : 3/7
BRUKER
MEDICAL
DEPASSEMENT
OVERSHOOTING
ECGMAX2
LIMIT
QRSFAS
ECGFV
QRSFV
ECG1500
ECGXXX
ECGQRS
ECGMAX2

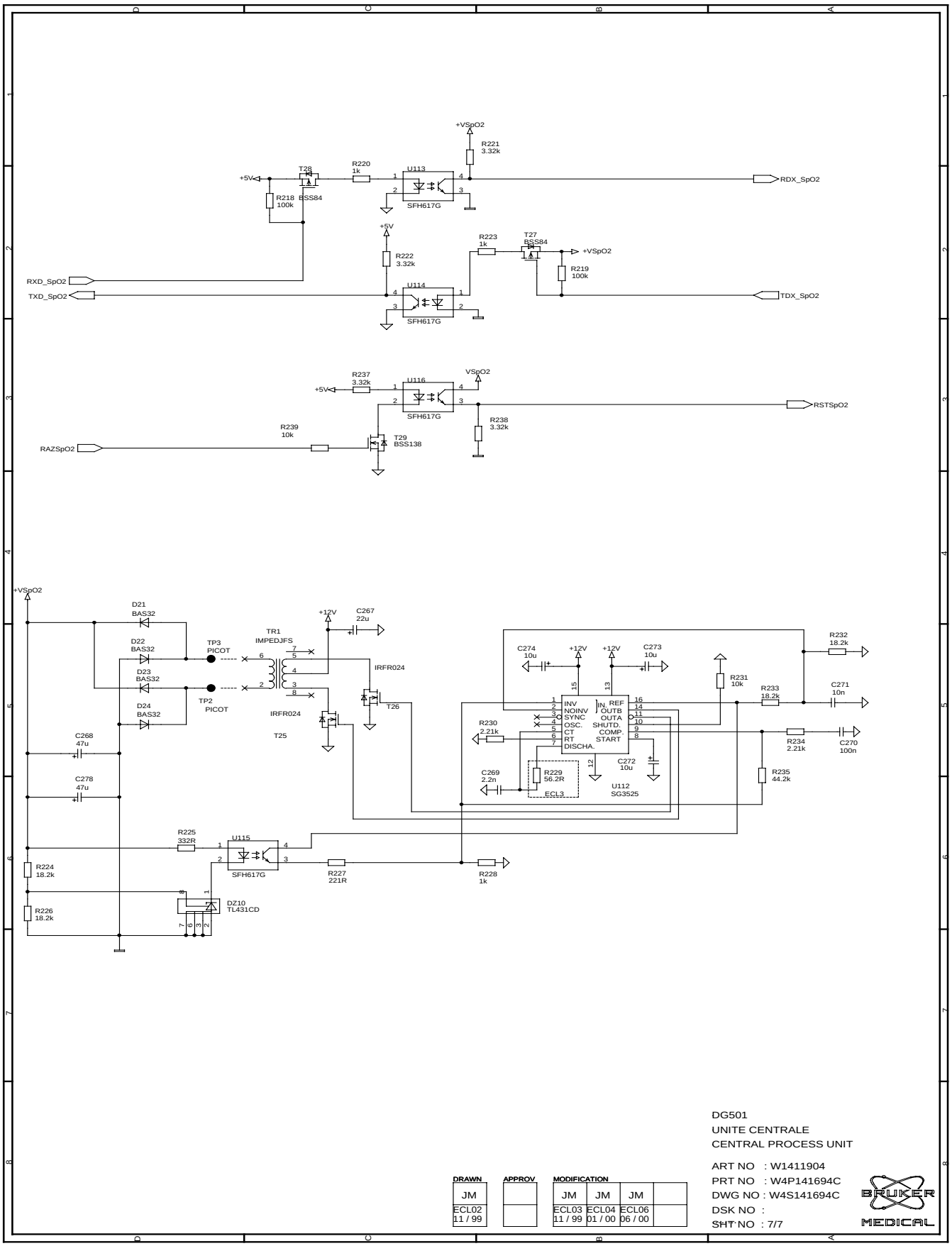
8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS



8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS




DG501
UNITE CENTRALE
CENTRAL PROCESS UNIT
ART NO : W1411904
PRT NO : W4P141694C
DWG NO : W4S141694C
DSK NO :
SHT NO : 6/7
DRAWN
JM
ECL02
11 / 99
APPROV
MODIFICATION
JM
ECL03
11 / 99
JM
ECL04
01 / 00
JM
ECL06
06 / 00
: NE PAS MONTER
U100
80C251SB
U101
74HC573 SMD
U102
27010
U103
74HC574 SMD
U104
TFDT4500 SMD
U105
74HC574 SMD
U106A
74HC32 SMD
U11F
74HC14 SMD
U14D
74HC32 SMD
U64F
74HC04 SMD
DVD[0..7]
AVD[0..15]
D_DVD[0..7]
D[0..7]
TM910OK
ERRORVID
READY_VID
BUSY_VID
-WR
-CSVIDEO
RAZVID
RST_VID
-WR_VID
-RD_VID
BUSY_VID
READY_VID
REVERSE
-CSLCD
-PSENVID
XTAL1
XTAL2
Q8
16M
C1201
18p
C200
18p
R205
33.2R
R206
33.2R
R207
0R
R208
0R

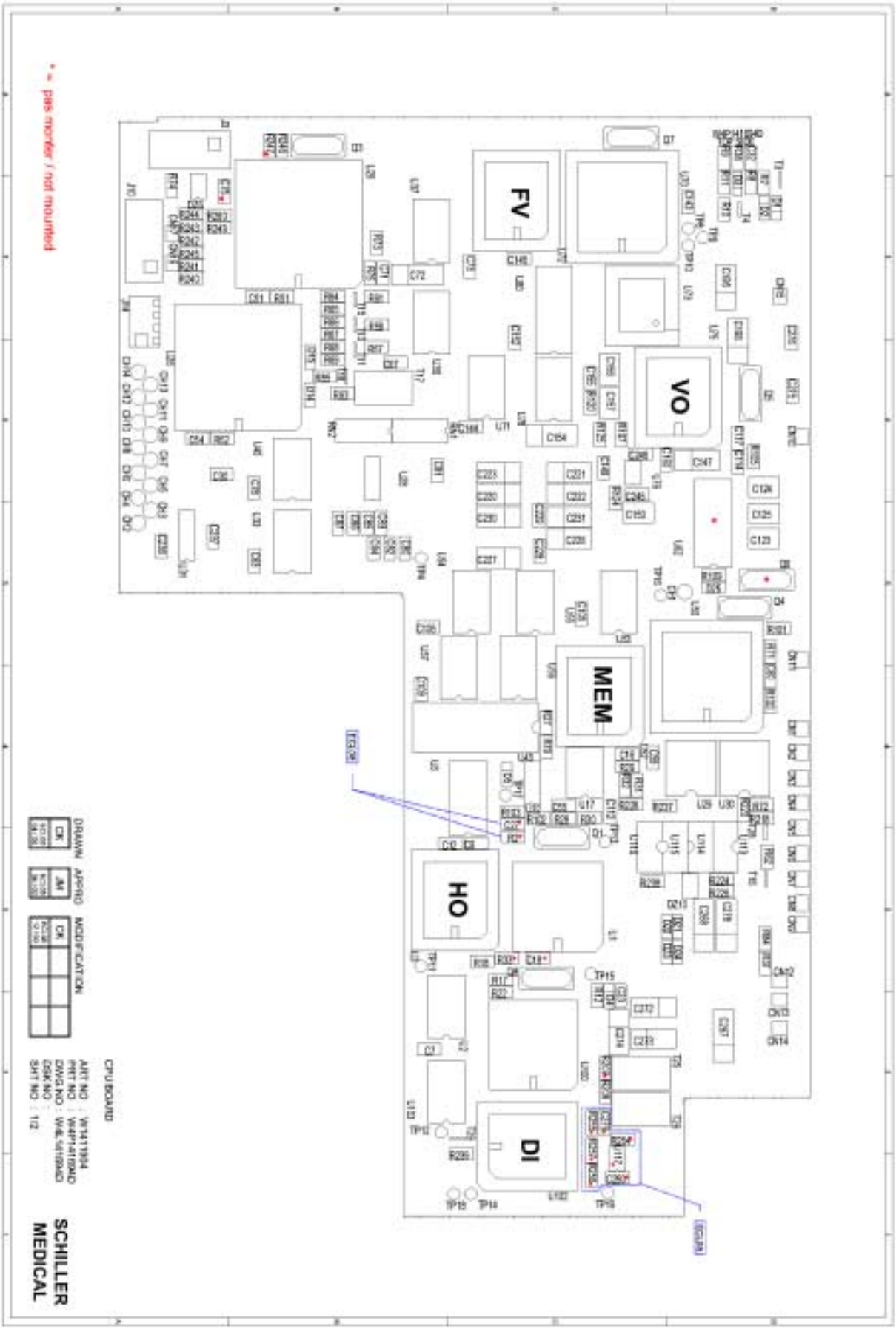


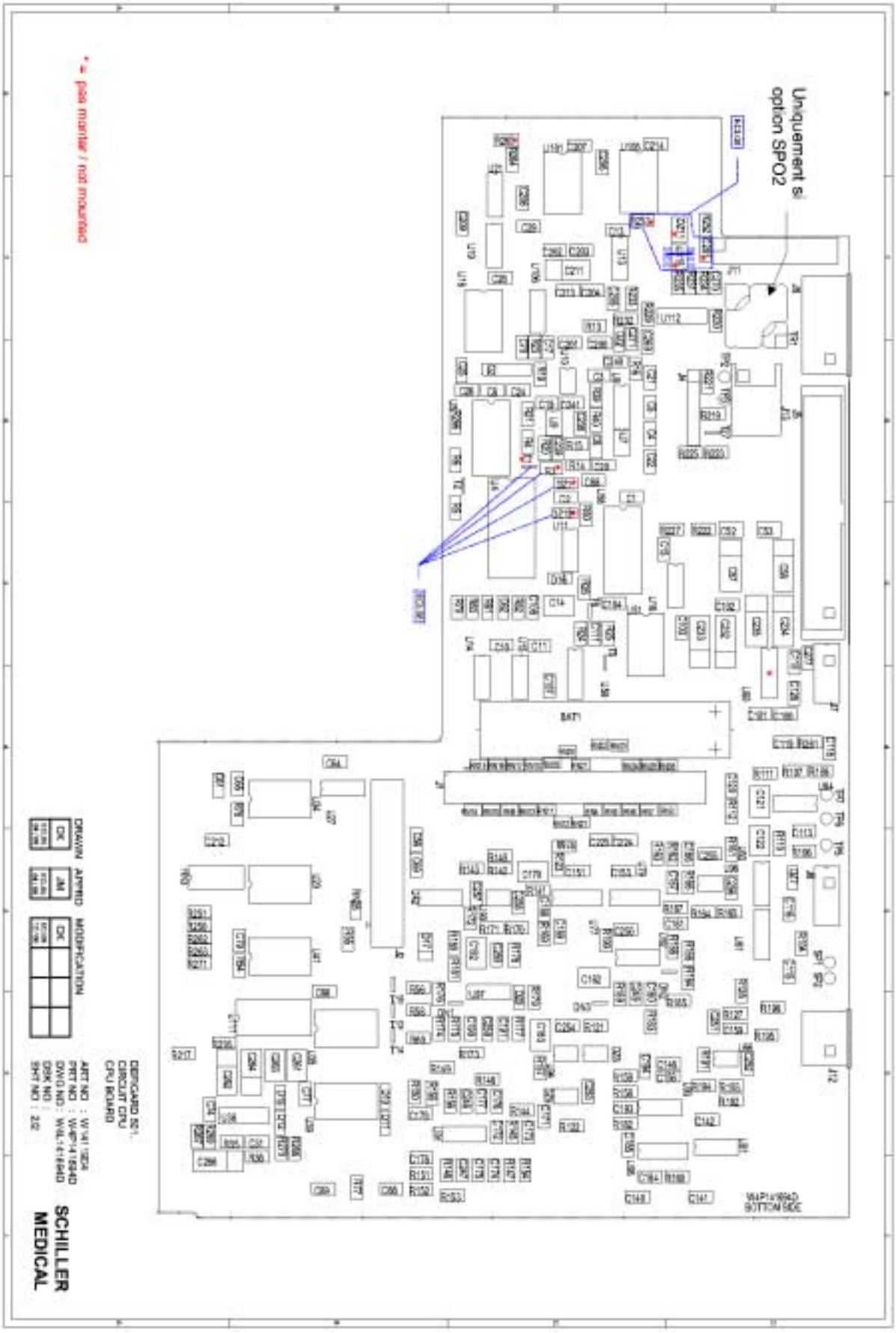
DG501
UNITE CENTRALE
CENTRAL PROCESS UNIT

ART NO : W1411904
PRT NO : W4P141694C
DWG NO : W4S141694C
DSK NO :
SHT NO : 7/7

DRAWN	APPROV	MODIFICATION			
JM		JM	JM	JM	
ECL02 11 / 99		ECL03 11 / 99	ECL04 01 / 00	ECL06 06 / 00	

BRUKER MEDICAL


* = pas monter / not mounted
FV
VO
MEM
HO
DI
DRAWN
APPRD
MODIFICATION
CPU BOARD
SCHILLER MEDICAL


* = pas montar / not mounted
Uniquement si option SPO2
DRAWN
APPRD
MODIFICATION
DEPOSARD SCI
CIRCUIT CPU
CPU BOARD
SCHILLER
MEDICAL

8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS

COMPONENT LIST OF CPU PCB

W4P14 1694D

POSITION	ITEM	DESCRIPTION	MANUFACTURER
BAT1	72253	LITHIUM CELL 3.6V AA	SONNEN
C1	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C10	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C100	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C101	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C102	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C103	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C104	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C105	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C106	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C107	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C108	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C109	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C11	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C110	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C111	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C112	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C113	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C114	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C115	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C116	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C117	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C118	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C119	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C12	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C120	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C1201	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C121	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C122	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C123	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C124	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C125	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C126	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C13	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C14	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C140	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C141	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C142	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C143	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C144	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C145	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C146	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C147	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C149	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C15	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C150	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C151	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C152	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C153	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM

C154	51556	CAPA SMD TANTAL 47U 16V 20%	SPRAGU
C155	20992	CAPA SMD 1206 150P 50V 5% NPO	VITRAM
C156	22597	CAPA SMD 1812 470N 50V 20% X7R	VITRAM
C157	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C158	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C159	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C16	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C160	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C17	21020	CAPA SMD 1206 33N 50V 10% X7R	VITRAM
C170	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C171	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C172	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C173	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C174	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C175	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C176	21010	CAPA SMD 1206 4.7N 50V 10% X7R	VITRAM
C177	21010	CAPA SMD 1206 4.7N 50V 10% X7R	VITRAM
C178	21010	CAPA SMD 1206 4.7N 50V 10% X7R	VITRAM
C179	21010	CAPA SMD 1206 4.7N 50V 10% X7R	VITRAM
C180	20986	CAPA SMD 1206 47P 50V 5% NPO	VITRAM
C181	72548	CAPA SMD 1206 47N 50V 5% X7R	VITRAM
C182	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C183	22597	CAPA SMD 1812 470N 50V 20% X7R	VITRAM
C184	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C185	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C186	72548	CAPA SMD 1206 47N 50V 5% X7R	VITRAM
C187	72548	CAPA SMD 1206 47N 50V 5% X7R	VITRAM
C188	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C189	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C19	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C190	20986	CAPA SMD 1206 47P 50V 5% NPO	VITRAM
C191	21020	CAPA SMD 1206 33N 50V 10% X7R	VITRAM
C192	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C193	20988	CAPA SMD 1206 68P 50V 5% NPO	VITRAM
C194	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C195	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C196	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C2	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C20	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C200	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C202	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C203	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C204	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C205	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C206	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C207	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C208	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C209	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C21	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C211	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C212	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C213	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C214	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C22	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C220	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C221	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C222	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C223	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C224	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM

C225	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C226	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C227	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C228	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C229	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C23	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C230	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C231	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C232	56394	CAPA SMD TANTAL 10U 35V 10%	SPRAGU
C233	56394	CAPA SMD TANTAL 10U 35V 10%	SPRAGU
C234	56394	CAPA SMD TANTAL 10U 35V 10%	SPRAGU
C235	56394	CAPA SMD TANTAL 10U 35V 10%	SPRAGU
C236	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C237	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C238	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C239	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C24	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C240	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C241	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C245	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C246	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C247	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C248	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C249	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C25	20979	CAPA SMD 1206 12P 50V 5% NPO	VITRAM
C250	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C251	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C252	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C253	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C254	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C255	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C256	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C257	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C258	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C259	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C26	20979	CAPA SMD 1206 12P 50V 5% NPO	VITRAM
C260	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C261	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C262	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C263	51518	CAPA SMD 1812 1U 50V 20% Y4T	VITRAM
C264	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C266	56394	CAPA SMD TANTAL 10U 35V 10%	SPRAGU
C267	51557	CAPA SMD TANTAL 22U 20V 10%	SPRAGU
C268	51556	CAPA SMD TANTAL 47U 16V 20%	SPRAGU
C269	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C270	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C271	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C272	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C273	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C274	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C275	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C276	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C277	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C278	51556	CAPA SMD TANTAL 47U 16V 20%	SPRAGU
C28	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C29	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C3	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C30	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C31	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM

C32	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C4	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C5	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C51	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C52	51954	CAPA SMD 1210 220N 50V 10% X7R	AVX
C53	51954	CAPA SMD 1210 220N 50V 10% X7R	AVX
C54	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C55	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C56	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C57	51557	CAPA SMD TANTAL 22U 20V 10%	SPRAGU
C58	51557	CAPA SMD TANTAL 22U 20V 10%	SPRAGU
C59	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C6	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C60	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C61	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C62	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C63	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C64	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C65	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C66	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C67	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C68	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C69	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C7	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C70	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C71	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C72	51557	CAPA SMD TANTAL 22U 20V 10%	SPRAGU
C73	20990	CAPA SMD 1206 100P 50V 5% NPO	VITRAM
C74	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C77	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C78	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C79	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C8	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C80	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C81	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C82	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C83	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C84	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C85	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C86	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C87	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C88	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C89	20981	CAPA SMD 1206 18P 50V 5% NPO	VITRAM
C9	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
CN1	79011	CAPA RES CER 4X10NF 50V X7R	AVX
CN10	79011	CAPA RES CER 4X10NF 50V X7R	AVX
CN11	79011	CAPA RES CER 4X10NF 50V X7R	AVX
CN12	79011	CAPA RES CER 4X10NF 50V X7R	AVX
CN13	79011	CAPA RES CER 4X10NF 50V X7R	AVX
CN14	79011	CAPA RES CER 4X10NF 50V X7R	AVX
CN2	79011	CAPA RES CER 4X10NF 50V X7R	AVX
CN3	79011	CAPA RES CER 4X10NF 50V X7R	AVX
CN4	79011	CAPA RES CER 4X10NF 50V X7R	AVX
CN5	79011	CAPA RES CER 4X10NF 50V X7R	AVX
CN6	79011	CAPA RES CER 4X10NF 50V X7R	AVX
CN7	79011	CAPA RES CER 4X10NF 50V X7R	AVX
CN8	79011	CAPA RES CER 4X10NF 50V X7R	AVX
D1	22029	DIODE SMD BAS32L SOD80	PHILIP
D10	22029	DIODE SMD BAS32L SOD80	PHILIP

D11	22029	DIODE SMD BAS32L SOD80	PHILIP
D12	22029	DIODE SMD BAS32L SOD80	PHILIP
D13	22029	DIODE SMD BAS32L SOD80	PHILIP
D14	22029	DIODE SMD BAS32L SOD80	PHILIP
D15	22029	DIODE SMD BAS32L SOD80	PHILIP
D16	22029	DIODE SMD BAS32L SOD80	PHILIP
D17	51586	DIODE SMD BYD37M SOD87	PHILIP
D2	22029	DIODE SMD BAS32L SOD80	PHILIP
D20	22029	DIODE SMD BAS32L SOD80	PHILIP
D21	22029	DIODE SMD BAS32L SOD80	PHILIP
D22	22029	DIODE SMD BAS32L SOD80	PHILIP
D23	22029	DIODE SMD BAS32L SOD80	PHILIP
D24	22029	DIODE SMD BAS32L SOD80	PHILIP
D25	51329	DIODE SMD BAS85 SOD80	PHILIP
D3	22029	DIODE SMD BAS32L SOD80	PHILIP
D4	51329	DIODE SMD BAS85 SOD80	PHILIP
D5	22029	DIODE SMD BAS32L SOD80	PHILIP
DN1	72501	DIODE SMD BAV199 SOT23	SIEMEN
DN2	72501	DIODE SMD BAV199 SOT23	SIEMEN
DN3	72501	DIODE SMD BAV199 SOT23	SIEMEN
DZ10	51832	IC 431/VREF TL431CD SO8 SMD	TI
DZ2	51393	DIODE Z SMD SOD80 5.1V	PHILIP
DZ6	51832	IC 431/VREF TL431CD SO8 SMD	TI
DZ7	51775	DIODE Z SMD SOD80 9.1V	PHILIP
DZ8	51832	IC 431/VREF TL431CD SO8 SMD	TI
DZ9	51832	IC 431/VREF TL431CD SO8 SMD	TI
J1	72979	CN M 140 D PRT 53481 SMD	MOLEX
J10	84306	CN M 10 S PC	LUMBER
J11	72978	CN M 72 D PRT 2X36 BERGSTICK	BERG
J12	72992	CN F 5 C PRT SERIES 5597	MOLEX
J13	72776	CN M 3 C PRT	JST
J2	72981	CN M 80 D PRT 53481 SMD	MOLEX
J3	84306	CN M 10 S PC	LUMBER
J4	53997	CN M 64 D PRT BARSIL	PRECID
J5	W1411840	CBL PL LIAISON CI CPU - CI HT	W2652
J6	72993	CN F 12 C PRT SERIES 5597	MOLEX
J7	77596	CN F 5 D PRT SERIES 5597	MOLEX
J8	77596	CN F 5 D PRT SERIES 5597	MOLEX
P1694D	W1404667	CI CPU DG501	OD2100
Q1	72529	QUARTZ 16.000MHZ HC-49/U-S	TELEQU
Q2	4372	QUARTZ 32.768KHZ	SARONI
Q3	51925	QUARTZ 11.0592MHZ	M-TRON
Q4	72529	QUARTZ 16.000MHZ HC-49/U-S	TELEQU
Q5	72702	QUARTZ 4.096MHZ HC49/U3H	JAUCH
Q7	72529	QUARTZ 16.000MHZ HC-49/U-S	TELEQU
Q8	72529	QUARTZ 16.000MHZ HC-49/U-S	TELEQU
R100	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R101	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R102	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R103	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R104	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R105	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R106	51734	RES SMD 2K 1% 0.25W 1206	BOURNS
R107	21637	RES SMD 10M 1% 0.25W 1206	BOURNS
R108	20730	RES SMD 332 1% 0.25W 1206	BOURNS
R109	51734	RES SMD 2K 1% 0.25W 1206	BOURNS
R110	51734	RES SMD 2K 1% 0.25W 1206	BOURNS
R111	51736	RES SMD 200K 1% 0.25W 1206	BOURNS
R112	51736	RES SMD 200K 1% 0.25W 1206	BOURNS

R12	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R120	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R121	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R122	20748	RES SMD 8.25K 1% 0.25W 1206	BOURNS
R123	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R124	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R125	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R126	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R127	53690	RES SMD 332K 1% 0.25W 1206	BOURNS
R13	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R14	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R140	51736	RES SMD 200K 1% 0.25W 1206	BOURNS
R141	21347	RES SMD 1M 1% 0.25W 1206	BOURNS
R142	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R143	53710	RES SMD 17.8K 1% 0.25W 1206	BOURNS
R144	53710	RES SMD 17.8K 1% 0.25W 1206	BOURNS
R145	53710	RES SMD 17.8K 1% 0.25W 1206	BOURNS
R146	53710	RES SMD 17.8K 1% 0.25W 1206	BOURNS
R147	53710	RES SMD 17.8K 1% 0.25W 1206	BOURNS
R148	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R149	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R15	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R150	51755	RES SMD 56.2K 1% 0.25W 1206	BOURNS
R151	53696	RES SMD 115K 1% 0.25W 1206	BOURNS
R152	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R153	53696	RES SMD 115K 1% 0.25W 1206	BOURNS
R154	21344	RES SMD 562K 1% 0.25W 1206	BOURNS
R155	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R156	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R157	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R158	21339	RES SMD 221K 1% 0.25W 1206	BOURNS
R159	21339	RES SMD 221K 1% 0.25W 1206	BOURNS
R16	51734	RES SMD 2K 1% 0.25W 1206	BOURNS
R160	51563	RES SMD 4.7M 1% 0.25W 1206	BOURNS
R161	51736	RES SMD 200K 1% 0.25W 1206	BOURNS
R162	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R163	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R164	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R165	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R166	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R167	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R168	51751	RES SMD 499K 1% 0.25W 1206	BOURNS
R169	21337	RES SMD 150K 1% 0.25W 1206	BOURNS
R17	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R170	51758	RES SMD 619K 1% 0.25W 1206	BOURNS
R171	21347	RES SMD 1M 1% 0.25W 1206	BOURNS
R172	33875	RES SMD 130K 1% 0.25W 1206	BOURNS
R173	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R174	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R175	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R176	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R177	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R178	53701	RES SMD 36.5K 1% 0.25W 1206	BOURNS
R179	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R18	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R180	21346	RES SMD 825K 1% 0.25W 1206	BOURNS
R181	21351	RES SMD 2.21M 1% 0.25W 1206	BOURNS
R182	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R183	51736	RES SMD 200K 1% 0.25W 1206	BOURNS

R184	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R185	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R186	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R187	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R188	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R189	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R19	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R190	72213	RES SMD 2.4M 1% 0.25W 1206	BOURNS
R191	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R192	59887	RES SMD 5.11K 1% 0.25W 1206	BOURNS
R193	73140	RES SMD 243K 1% 0.25W 1206	BOURNS
R194	21339	RES SMD 221K 1% 0.25W 1206	BOURNS
R195	20715	RES SMD 22.1 1% 0.25W 1206	BOURNS
R196	20715	RES SMD 22.1 1% 0.25W 1206	BOURNS
R20	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R208	21352	RES SMD 0 5% 0.25W 1206	BOURNS
R21	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R216	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R217	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R218	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R219	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R22	21352	RES SMD 0 5% 0.25W 1206	BOURNS
R220	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R221	20743	RES SMD 3.32K 1% 0.25W 1206	BOURNS
R222	20743	RES SMD 3.32K 1% 0.25W 1206	BOURNS
R223	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R224	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R225	20730	RES SMD 332 1% 0.25W 1206	BOURNS
R226	53710	RES SMD 17.8K 1% 0.25W 1206	BOURNS
R227	20728	RES SMD 221 1% 0.25W 1206	BOURNS
R228	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R229	20720	RES SMD 56.2 1% 0.25W 1206	BOURNS
R23	21338	RES SMD 182K 1% 0.25W 1206	BOURNS
R230	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R231	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R232	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R233	21326	RES SMD 18.2K 1% 0.25W 1206	BOURNS
R234	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R235	51746	RES SMD 44.2K 1% 0.25W 1206	BOURNS
R237	20743	RES SMD 3.32K 1% 0.25W 1206	BOURNS
R238	20743	RES SMD 3.32K 1% 0.25W 1206	BOURNS
R239	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R24	51734	RES SMD 2K 1% 0.25W 1206	BOURNS
R240	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R241	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R242	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R243	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R244	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R245	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R246	21352	RES SMD 0 5% 0.25W 1206	BOURNS
R249	21352	RES SMD 0 5% 0.25W 1206	BOURNS
R25	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R250	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R251	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R252	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R26	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R261	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R262	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R263	21335	RES SMD 100K 1% 0.25W 1206	BOURNS

R264	21352	RES SMD 0 5% 0.25W 1206	BOURNS
R266	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R267	21352	RES SMD 0 5% 0.25W 1206	BOURNS
R268	21352	RES SMD 0 5% 0.25W 1206	BOURNS
R269	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R27	51748	RES SMD 475K 1% 0.25W 1206	BOURNS
R270	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R271	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R28	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R30	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R31	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R32	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R35	21347	RES SMD 1M 1% 0.25W 1206	BOURNS
R36	21342	RES SMD 392K 1% 0.25W 1206	BOURNS
R37	20745	RES SMD 4.7K 1% 0.25W 1206	BOURNS
R38	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R39	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R4	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R40	51766	RES SMD 75K 1% 0.25W 1206	BOURNS
R5	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R51	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R52	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R54	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R55	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R56	20739	RES SMD 1.5K 1% 0.25W 1206	BOURNS
R57	20739	RES SMD 1.5K 1% 0.25W 1206	BOURNS
R58	20739	RES SMD 1.5K 1% 0.25W 1206	BOURNS
R59	20739	RES SMD 1.5K 1% 0.25W 1206	BOURNS
R6	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R60	20739	RES SMD 1.5K 1% 0.25W 1206	BOURNS
R61	20739	RES SMD 1.5K 1% 0.25W 1206	BOURNS
R62	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R63	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R64	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R65	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R66	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R67	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R68	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R69	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R7	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R70	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R71	21347	RES SMD 1M 1% 0.25W 1206	BOURNS
R72	51732	RES SMD 2 5% 0.25W 1206	BOURNS
R73	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R74	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R75	20711	RES SMD 10 1% 0.25W 1206	BOURNS
R77	21352	RES SMD 0 5% 0.25W 1206	BOURNS
R78	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R79	51748	RES SMD 475K 1% 0.25W 1206	BOURNS
R8	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R80	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R81	51748	RES SMD 475K 1% 0.25W 1206	BOURNS
R82	21342	RES SMD 392K 1% 0.25W 1206	BOURNS
R83	21339	RES SMD 221K 1% 0.25W 1206	BOURNS
R84	51288	RES SMD 475 1% 0.25W 1206	BOURNS
R85	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R9	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
RN1	22487	RES RES 10KX8 2% SOM16	BOURNS
RN10	83560	RES NET CAT 4X33 SMD 1206	BOURNS

RN11	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN12	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN13	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN14	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN15	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN16	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN17	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN18	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN19	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN2	22487	RES RES 10KX8 2% SOM16	BOURNS
RN20	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN21	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN22	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN23	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN24	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN25	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN26	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN27	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN28	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN3	51840	RES RES 100KX8 2% SOM16	BOURNS
RN4	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN5	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN6	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN7	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN8	83560	RES NET CAT 4X33 SMD 1206	BOURNS
RN9	83560	RES NET CAT 4X33 SMD 1206	BOURNS
S102	72935	IC SUPPORT PLCC32 SMD	AMP
S3	72935	IC SUPPORT PLCC32 SMD	AMP
S52	72935	IC SUPPORT PLCC32 SMD	AMP
S72	72935	IC SUPPORT PLCC32 SMD	AMP
S75	72935	IC SUPPORT PLCC32 SMD	AMP
SP1	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
SP2	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
SQ1	72175	INSULATING QUARTZ	JAUCH
SQ3	72175	INSULATING QUARTZ	JAUCH
SQ4	72175	INSULATING QUARTZ	JAUCH
SQ5	72175	INSULATING QUARTZ	JAUCH
SQ7	72175	INSULATING QUARTZ	JAUCH
SQ8	72175	INSULATING QUARTZ	JAUCH
T10	51470	TRANS SMD BSS138 SOT23	SIEMEN
T11	51470	TRANS SMD BSS138 SOT23	SIEMEN
T12	51470	TRANS SMD BSS138 SOT23	SIEMEN
T13	51470	TRANS SMD BSS138 SOT23	SIEMEN
T14	51470	TRANS SMD BSS138 SOT23	SIEMEN
T15	51470	TRANS SMD BSS138 SOT23	SIEMEN
T16	51471	TRANS SMD BSS84 SOT23	SIEMEN
T17	51365	TRANS SMD IRFR9024 ROLL	IR
T18	51470	TRANS SMD BSS138 SOT23	SIEMEN
T2	51777	TRANS SMD BC860C PNP SOT23	SIEMEN
T25	51364	TRANS SMD IRFR024N TR	IR
T26	51364	TRANS SMD IRFR024N TR	IR
T27	51471	TRANS SMD BSS84 SOT23	SIEMEN
T28	51471	TRANS SMD BSS84 SOT23	SIEMEN
T29	51470	TRANS SMD BSS138 SOT23	SIEMEN
T3	51779	TRANS SMD BC850C NPN SOT23	MOTORO
T5	51779	TRANS SMD BC850C NPN SOT23	MOTORO
T6	51777	TRANS SMD BC860C PNP SOT23	SIEMEN
TP10	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP11	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY

TP12	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP13	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP14	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP15	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP16	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP17	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP18	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP19	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP2	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
TP3	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
TP4	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP5	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
TP6	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
TP7	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
TP8	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
TP9	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY
U1	72598	IC 80251/MCU N80C251SB16PLCC44	INTEL
U10	51675	IC 062/OP TL062CD SO8 SMD	TI
U100	72598	IC 80251/MCU N80C251SB16PLCC44	INTEL
U101	51498	IC 74573/74HC573D SOL20 SMD	PHILIP
U102	59878	IC 27010/EPRO 128KX8 PLCC32	AMD
U103	51902	IC 74574/SN74HC574DW SOL20CMS	TI
U105	51902	IC 74574/SN74HC574DW SOL20CMS	TI
U106	51782	IC 7432/SN74HC32D SO14 SMD	TI
U11	22320	IC 7414/SN74HC14D SO14 SMD	TI
U111	79039	IC 239/DRV MAX239-RS232 SOL24	MAXIM
U112	84126	IC 3525 /SG3525AP SO16	ST
U113	72546	OPTO COUP SFH617G-3	SIEMEN
U114	72546	OPTO COUP SFH617G-3	SIEMEN
U115	72546	OPTO COUP SFH617G-3	SIEMEN
U116	72546	OPTO COUP SFH617G-3	SIEMEN
U13	72524	IC 7420/SN74HCT20D SO14 SMD	TI
U14	51782	IC 7432/SN74HC32D SO14 SMD	TI
U15	72238	IC 4075/SN74HC4075D00 SO14 SMD	TI
U16	51782	IC 7432/SN74HC32D SO14 SMD	TI
U17	72633	IC 691/MAX691CWE SOL16	MAXIM
U18	51902	IC 74574/SN74HC574DW SOL20CMS	TI
U19	51782	IC 7432/SN74HC32D SO14 SMD	TI
U2	51498	IC 74573/74HC573D SOL20 SMD	PHILIP
U20	51498	IC 74573/74HC573D SOL20 SMD	PHILIP
U21	72238	IC 4075/SN74HC4075D00 SO14 SMD	TI
U25	67969	IC 16554 /TL16C554 PLCC68	TI
U26	67969	IC 16554 /TL16C554 PLCC68	TI
U27	51782	IC 7432/SN74HC32D SO14 SMD	TI
U28	51467	IC 7474/74HC74D SO14 SMD	PHILIP
U29	69275	IC 380 /LM380N-8 DIL8	NS
U3	59878	IC 27010/EPRO 128KX8 PLCC32	AMD
U30	69275	IC 380 /LM380N-8 DIL8	NS
U31	17938	IC 508/MUX DG508A SO16 8CH-MUX	TEMIC
U32	51799	IC 7402/SN74HC02D SO14 SMD	TI
U33	51902	IC 74574/SN74HC574DW SOL20CMS	TI
U34	51902	IC 74574/SN74HC574DW SOL20CMS	TI
U35	51902	IC 74574/SN74HC574DW SOL20CMS	TI
U36	51902	IC 74574/SN74HC574DW SOL20CMS	TI
U37	51919	IC 0802/ADC0802LCWM SO20 SMD	NS
U38	51953	IC 4051/MUX HEF4051BT SO16	PHILIP
U39	51498	IC 74573/74HC573D SOL20 SMD	PHILIP
U4	84135	IC 621024 /IS62C1024L-70Q SOP	ISSI
U40	51498	IC 74573/74HC573D SOL20 SMD	PHILIP

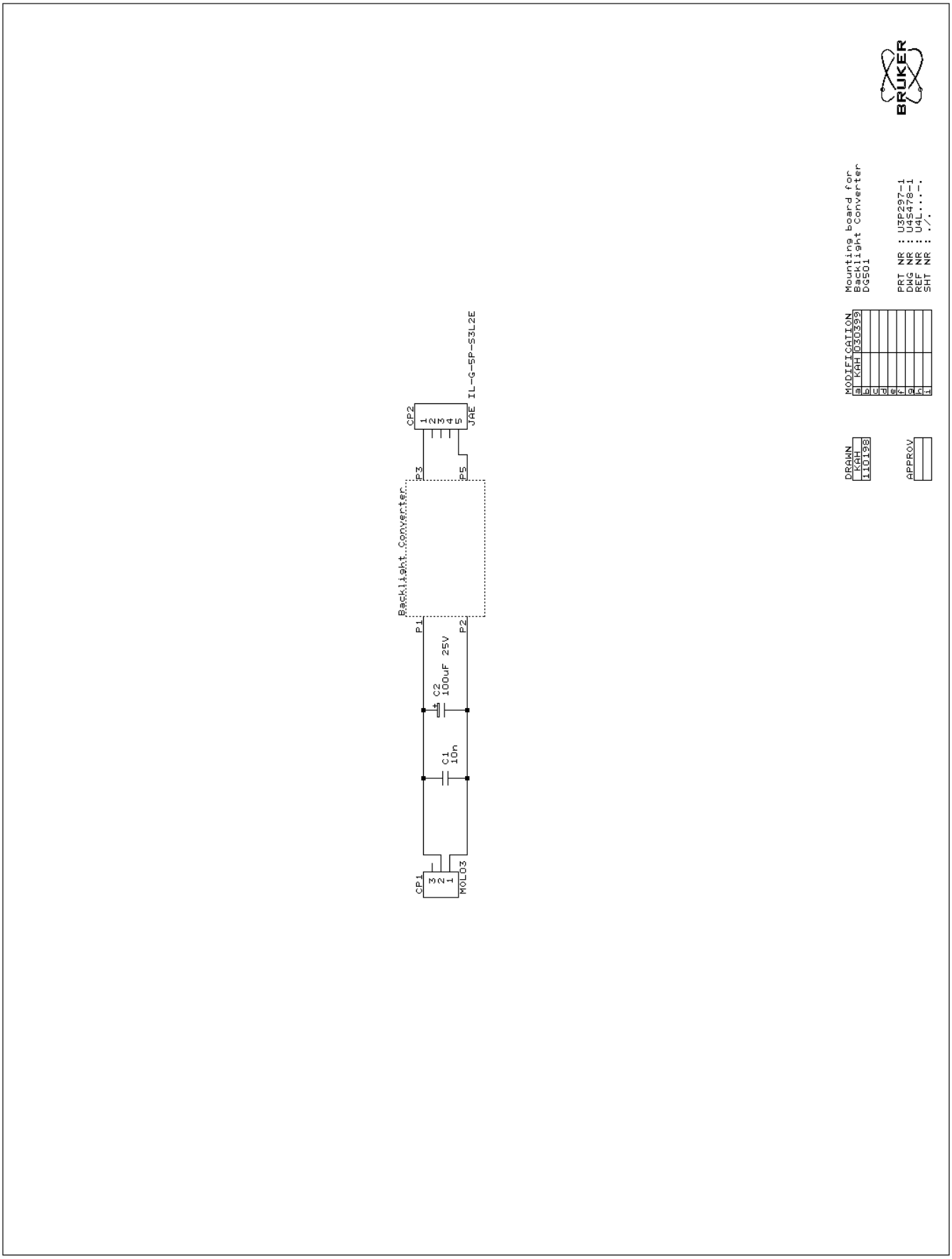
U41	51498	IC 74573/74HC573D SOL20 SMD	PHILIP
U42	51466	IC 7408/74HC08D SO14 SMD	PHILIP
U43	U06051	EPROM TM910S PIC16C54 RS3.3 P.	OD3200
U5	72983	IC 1685 TIMER DS168 SOL24 SMD	DALLAS
U50	72598	IC 80251/MCU N80C251SB16PLCC44	INTEL
U51	51498	IC 74573/74HC573D SOL20 SMD	PHILIP
U52	59878	IC 27010/EPRO 128KX8 PLCC32	AMD
U53	51902	IC 74574/SN74HC574DW SOL20CMS	TI
U54	51902	IC 74574/SN74HC574DW SOL20CMS	TI
U55	51902	IC 74574/SN74HC574DW SOL20CMS	TI
U56	51902	IC 74574/SN74HC574DW SOL20CMS	TI
U57	22323	IC 74245/SN74HC245DW SOL20 SMD	TI
U58	51531	IC 43256/SRAM SOP 28 SMD	NEC
U59	51270	IC 74138/SN74HC138D SO16 SMD	TI
U6	51537	IC 74154/MC74HC154DW SOL24CMS	TI
U61	51795	IC 4060/CD HEF4060BT SO16 SMD	PHILIP
U63	51466	IC 7408/74HC08D SO14 SMD	PHILIP
U64	51915	IC 7404/MC74HC04AD SO14 SMD	MOTORO
U66	51675	IC 062/OP TL062CD SO8 SMD	TI
U7	69967	IC 9356 /M93C56 SO8	STM
U70	72598	IC 80251/MCU N80C251SB16PLCC44	INTEL
U71	51498	IC 74573/74HC573D SOL20 SMD	PHILIP
U72	59878	IC 27010/EPRO 128KX8 PLCC32	AMD
U73	51534	IC 6295/DSP MSM6295 SMD	OKI
U75	79000	IC FLASH MEMORY 4MB PLCC32	STM
U76	51675	IC 062/OP TL062CD SO8 SMD	TI
U77	51536	IC 7524/AD7524JR SO16 SMD	ANALOG
U78	51919	IC 0802/ADC0802LCWM SO20 SMD	NS
U79	51270	IC 74138/SN74HC138D SO16 SMD	TI
U8	84146	IC 5620 /TLC5620CD SO14	TI
U80	51531	IC 43256/SRAM SOP 28 SMD	NEC
U81	51546	IC 74393/74HC393M SO14 SMD	PHILIP
U9	33924	IC 358A/OP LM358AM SO8 SMD	NS
U90	51675	IC 062/OP TL062CD SO8 SMD	TI
U91	51545	IC 064/OP TL064CD SO14 SMD	ST
U92	51545	IC 064/OP TL064CD SO14 SMD	ST
U93	51791	IC 4093/CD HEF4093BT SO14 SMD	PHILIP
U94	33924	IC 358A/OP LM358AM SO8 SMD	NS
U95	51676	IC 4538/CD HEF4538BT SO16 SMD	PHILIP
U96	33924	IC 358A/OP LM358AM SO8 SMD	NS
U97	51545	IC 064/OP TL064CD SO14 SMD	ST
	W1411839	BACKLIGHT CONVERTER CBL	W2652
	W1405016	FRONT FIXING PIECE CPU DG501	LIP
	W1404965	FIXING PIECE CPU DG501	LIP
	34926	ACCBL SLVE THERMO B-EX 160/10	SES
	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
	42990	ACCBL PIN TEST SMD D=1.0MM	OXLEY

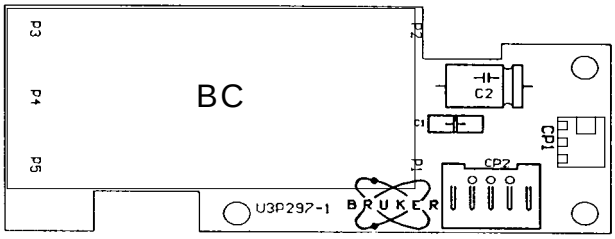
8.11. BACKLIGHTING CONVERTER SUPPORT PRINTED CIRCUIT BOARD

Article no.: **W141 1909**

Description: **BACKLIGHT CONVERTER SUPPORT PCB**

Reference: **U3P297-1**


BRUKER
Mounting board for
Backlight Converter
D4501
PRT NR : U3P297-1
DWG NR : U4S478-1
REF NR : U4L...-.
SHT NR : 1/.
MODIFICATION
a KAH 030399
DRAWN
KAH
110198
APPROV
CP2
1 2 3 4 5
JAE IL-G-5P-S3L2E
P3
P5
Backlight Converter
P1
P2
C2
100uF 25V
C1
10n
CP1
3 2 1
MOLO3



DEFIGARD 501.
RETRO ECLAIRAGE

DRAWN	APPROV	MODIFICATION
ECL0	ECL0	
04/99	04/99	

ART NO : W1411909
PRT NO : U3P297-1
DWG NO : W4L14U297-1
DSK NO :
SHT NO : 1/1

BRUKER MEDICAL

BACKLIGHT CONVERTER SUPPORT PCB COMPONENT LIST

U3P297-2

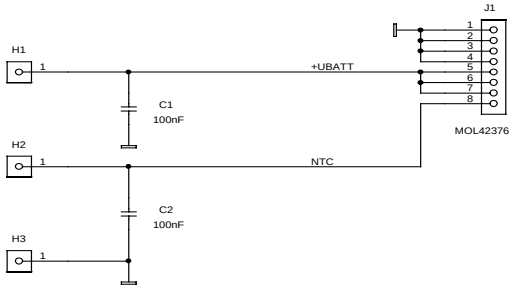
POSITION	ITEM	DESCRIPTION	MANUFACTURER
BC	72934	CONVERTER FOR LCD SCREEN	TDK
C1	31185	CAPA MKS 10N 100V 10% R5	WIMA
C2	8125	CAPA CHIMI AX 100U 25V 6X10	PHILIP
CP1	5615	CN M 3 C PRT MODU2	AMP
CP2	84391	REPLACE BY 72976	JAE
P297-1	U07297	DG501 BACKLIGHT SUPPLY	POLYTR

8.12. BATTERY INTERFACE PRINTED CIRCUIT BOARD

Article no.: **W141 1787**

Description: **BATTERY INTERFACE PCB**

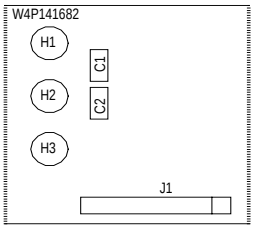
Reference: **W4P14 1682**



DG 501
INTERFACE BATTERIE
BATTERY INTERFACE

ART NO : W1411787
PRT NO : W4P141682
DWG NO : W4S141682
DSK NO :
SHT NO : 1/1

DRAWN	APPROV	MODIFICATION			
RH	CK				
ECL00 03 / 99	ECL00 03 / 99				



DRAWN	APPROV	MODIFICATION
ECL0	ECL0	
04/99	04/99	

DEFIGARD 501.
INTERFACE BATTERIE
BATTERY INTERFACE

ART NO : W1411787
PRT NO : W4P141682
DWG NO : W4L141682
DSK NO :
SHT NO : 1/1

BRUKER MEDICAL

8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS

COMPONENT LIST OF BATTERY INTERFACE PCB

W4P14 1682

POSITION	ITEM	DESCRIPTION	MANUFACTURER
C1	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C2	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
J1	72930	CN M 36 C PRT 0.64X0.64MM	MOLEX
P1682	W1404650	BATTERY INTERFACE IC DG501	CIRE

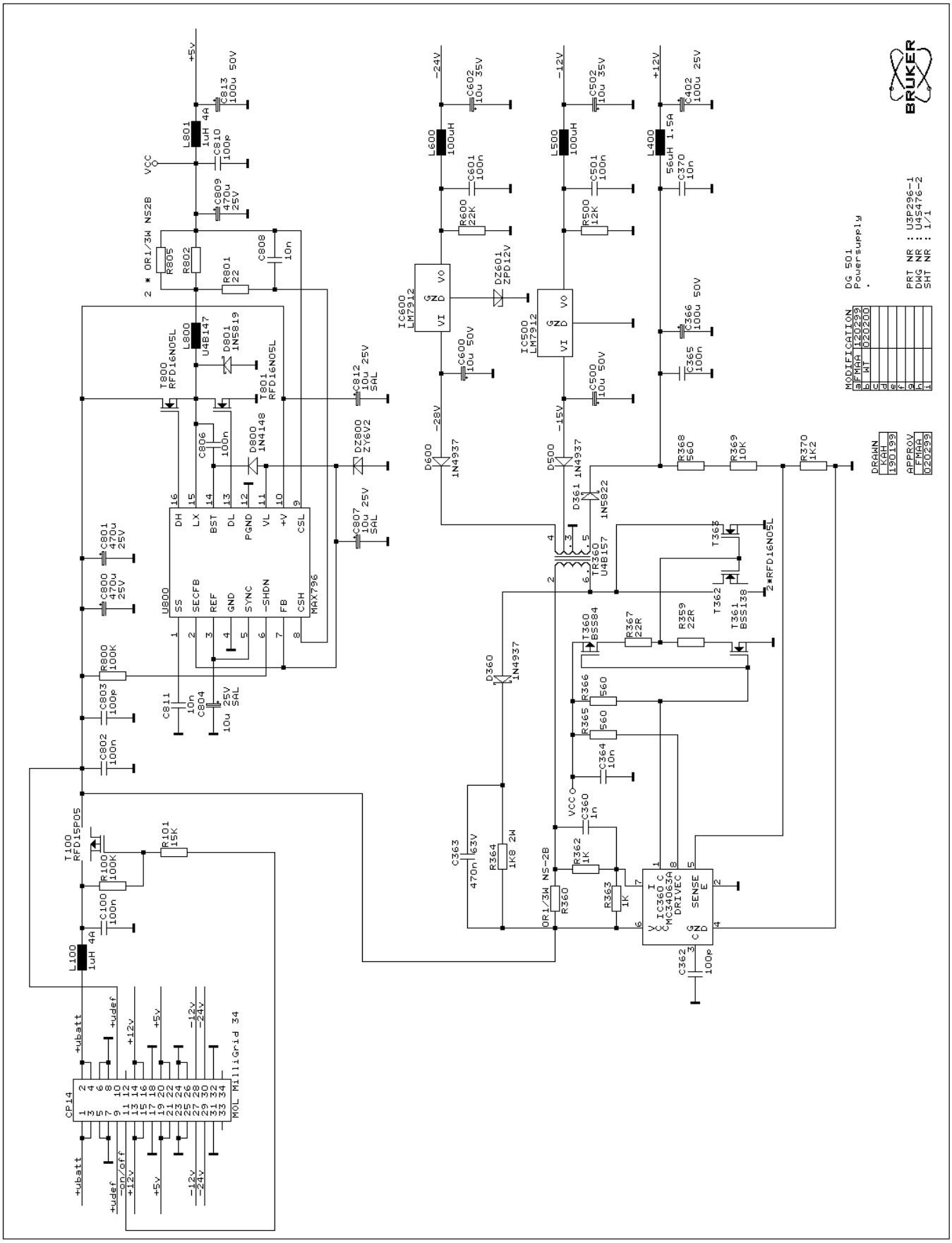
8.13. POWER SUPPLY PRINTED CIRCUIT BOARD

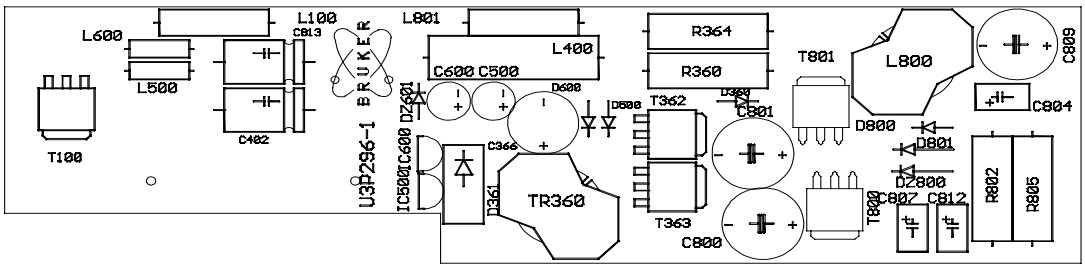
Article no.: **U53 296**

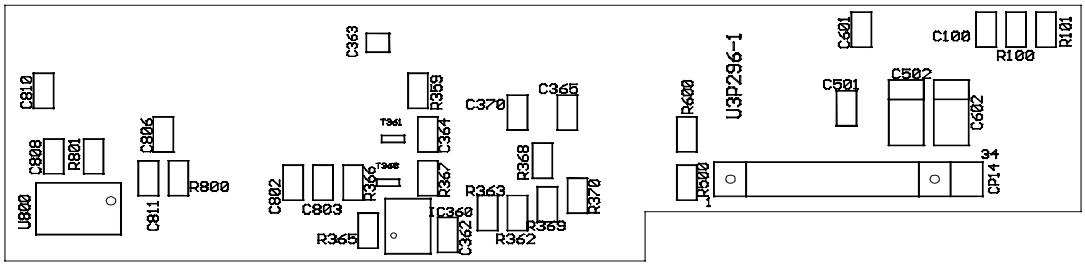
Description: **POWER SUPPLY PCB**

Reference: **U3P296-1**

8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS







DEFIGARD 501.
ALIMENTATION
POWER SUPPLY

DRAWN	APPROV	MODIFICATION
ECL0	ECL0	
04/99	04/99	

ART NO : U53296
PRT NO : U3P296-1
DWG NO : W4L14U296-1
DSK NO :
SHT NO : 1/1

BRUKER MEDICAL

8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS

COMPONENT LIST OF POWER SUPPLY PCB

U3P296-1

POSITION	ITEM	DESCRIPTION	MANUFACTURER
CP14	72948	CN F 34 C MILLI-GRID SMD	MOLEX
C100	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C360	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C362	20990	CAPA SMD 1206 100P 50V 5% NPO	VITRAM
C363	22597	CAPA SMD 1812 470N 50V 20% X7R	VITRAM
C364	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C365	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C366	67238	CAPA CHIMI RAD 100U/25V R5	PHILIP
C370	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C402	67392	KOND ELKO AX 100U 25V 6.3X10.5	PHILIP
C500	5223	CAPA ELECT RAD 10U 50V R5	NICHIC
C501	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C502	56394	CAPA SMD TANTAL 10U 35V 10%	SPRAGU
C600	5223	CAPA ELECT RAD 10U 50V R5	NICHIC
C601	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C602	56394	CAPA SMD TANTAL 10U 35V 10%	SPRAGU
C800	67236	CAPA ELECT RAD 470U/25V R5	PHILIP
C801	67236	CAPA ELECT RAD 470U/25V R5	PHILIP
C802	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C803	20990	CAPA SMD 1206 100P 50V 5% NPO	VITRAM
C804	3669	CAPA CHIMI RAD ALU 10U 25V R5	PHILIP
C806	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C807	3669	CAPA CHIMI RAD ALU 10U 25V R5	PHILIP
C808	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C809	67236	CAPA ELECT RAD 470U/25V R5	PHILIP
C810	20990	CAPA SMD 1206 100P 50V 5% NPO	VITRAM
C811	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C812	3669	CAPA CHIMI RAD ALU 10U 25V R5	PHILIP
C813	67392	KOND ELKO AX 100U 25V 6.3X10.5	PHILIP
DZ601	9812	DIODE Z ZY 12 2W	ITT
DZ800	51942	DIODE Z ZY 6.2V 2W	ITT
D360	51868	DIODE 1N4937	MOTORO
D361	84407	DIODE S SR506 DO201AD 60V 5A	INDEG
D500	51868	DIODE 1N4937	MOTORO
D600	51868	DIODE 1N4937	MOTORO
D800	2967	DIODE 1N4148	ITT
D801	65760	DIODE 1N5819	G.INST
IC360	72763	IC 34063/VREG MC34063AD SO8	MOTORO
IC500	13052	IC 7912/VREG MC79L12ACP TO92	MOTORO
IC600	13052	IC 7912/VREG MC79L12ACP TO92	MOTORO
L100	65341	SELF 1UH 4A SMSC	FASTRO
L400	12715	SELF 56UH 1.5A	SIEMEN
L500	67600	CHOKE IM-2 100UH 10%	DALE
L600	67600	CHOKE IM-2 100UH 10%	DALE
L800	U21147	CORE FERRITE MOUNT.	EMED
L801	65341	SELF 1UH 4A SMSC	FASTRO
PRT	U07296	DG501 POWER SUPPLY PCB	POLYTR
R100	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R101	21325	RES SMD 15K 1% 0.25W 1206	BOURNS
R359	20715	RES SMD 22.1 1% 0.25W 1206	BOURNS

R360	69276	RES WIRE 1% 3W 0.1	DALE
R362	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R363	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R364	69277	RES WIRE 1% 3W 1.8K	DALE
R365	20733	RES SMD 562 1% 0.25W 1206	BOURNS
R366	20733	RES SMD 562 1% 0.25W 1206	BOURNS
R367	20715	RES SMD 22.1 1% 0.25W 1206	BOURNS
R368	20733	RES SMD 562 1% 0.25W 1206	BOURNS
R369	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R370	20738	RES SMD 1.21K 1% 0.25W 1206	BOURNS
R500	21324	RES SMD 12.1K 1% 0.25W 1206	BOURNS
R600	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R800	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R801	20715	RES SMD 22.1 1% 0.25W 1206	BOURNS
R802	69276	RES WIRE 1% 3W 0.1	DALE
R805	69276	RES WIRE 1% 3W 0.1	DALE
TR360	U21157	CORE FERRITE MOUNT.	EMED
T100	68376	TRANS RFD15P05 TO-251AA	HARRIS
T360	51471	TRANS SMD BSS84 SOT23	SIEMEN
T361	51470	TRANS SMD BSS138 SOT23	SIEMEN
T362	69914	TRANS RFD16N05L TO-251AA	HARRIS
T363	69914	TRANS RFD16N05L TO-251AA	HARRIS
T800	69914	TRANS RFD16N05L TO-251AA	HARRIS
T801	69914	TRANS RFD16N05L TO-251AA	HARRIS
U800	67968	IC 796 /MAX796CSE SO16 SMD	TI

8.14. HIGH-VOLTAGE CIRCUIT PRINTED CIRCUIT BOARD

Article no.: **W141 2006**

Description: **HIGH VOLTAGE PCB**

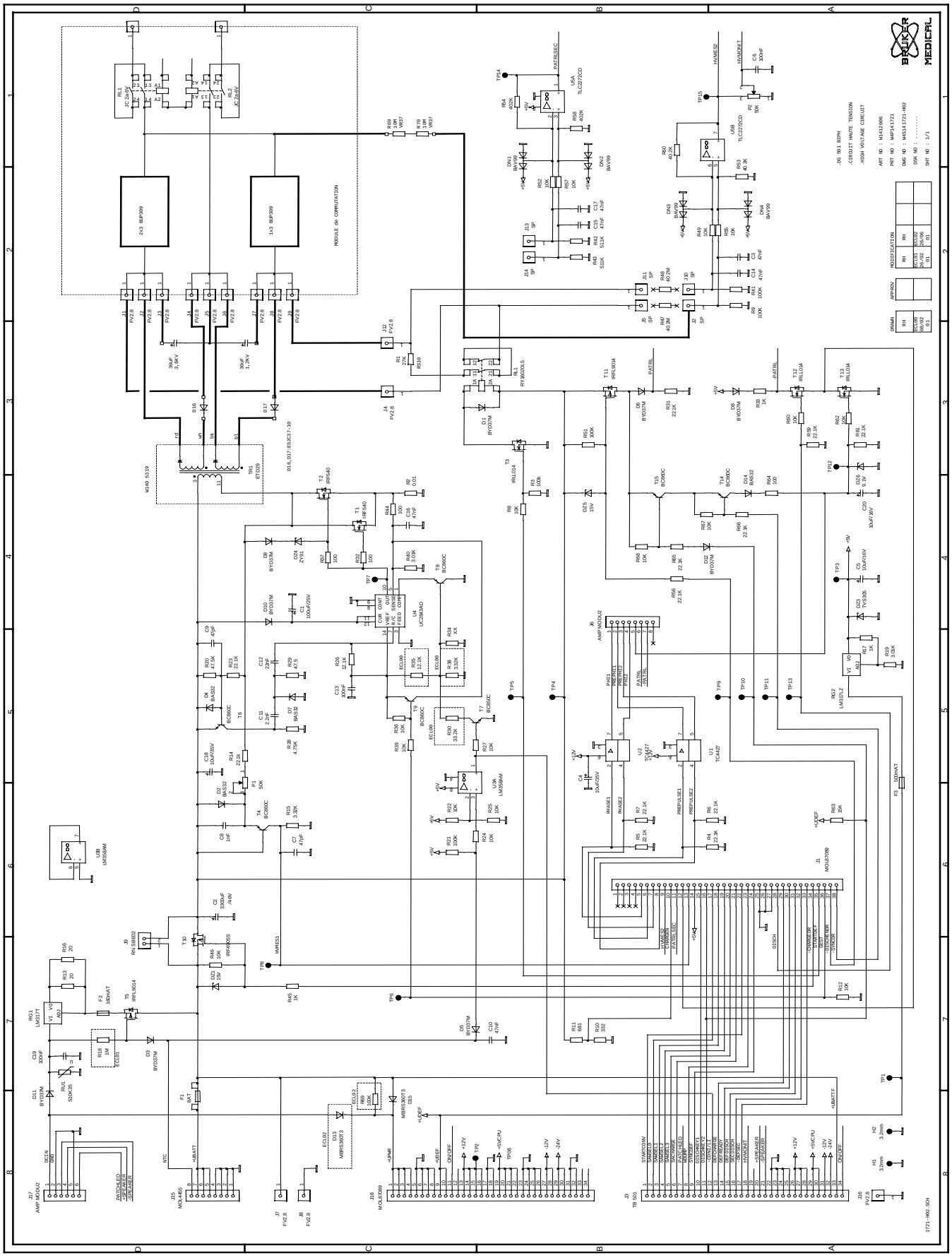
Reference: **W4P14 1721**

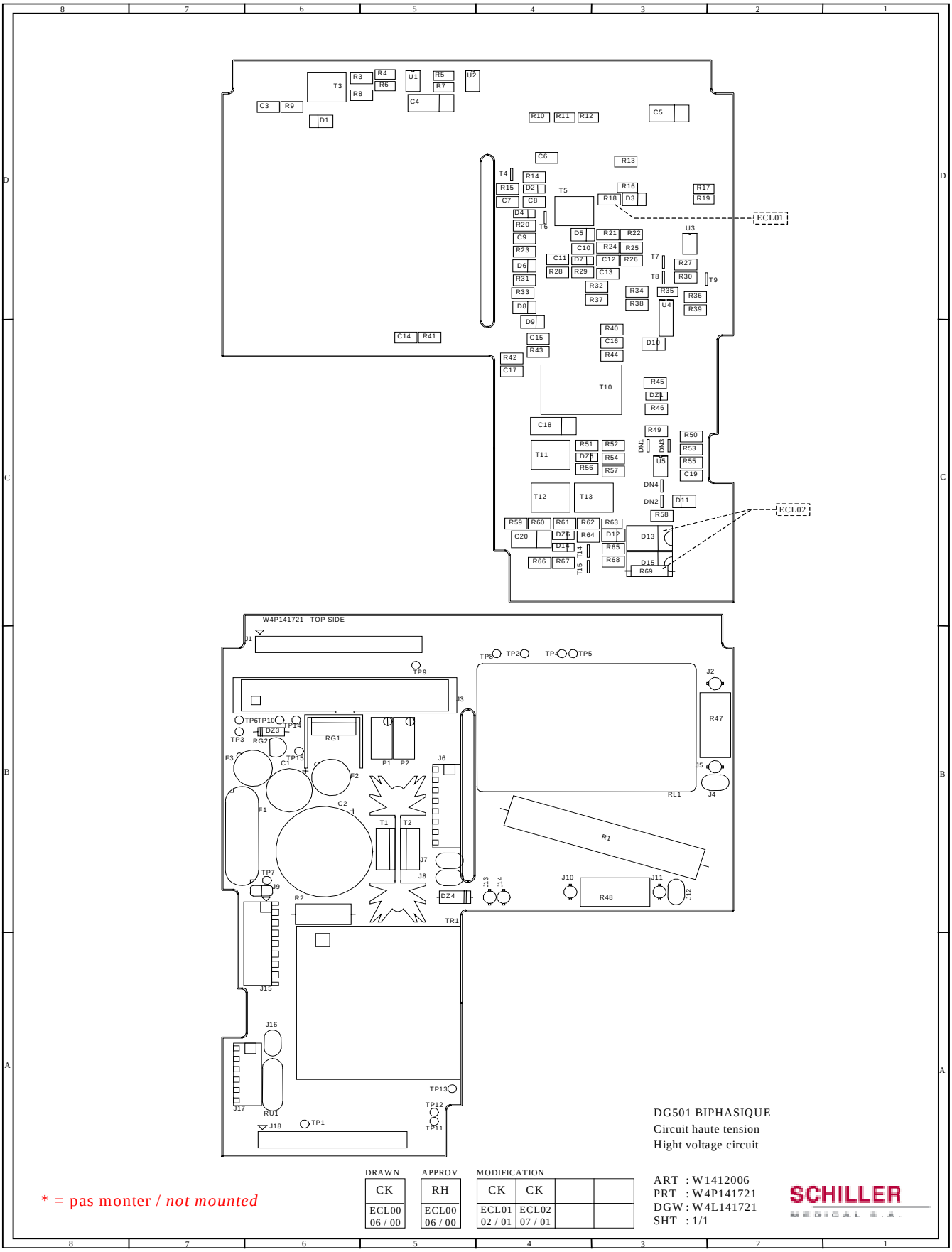
Adjustments:

The high-voltage PCB offers two adjustments:
1. **Adjustment of the energy supplied by the defibrillator (P1)**
2. **Adjustment of the HV capacitor voltage measurement signal, HVMONIT (P2)**

Adjustment	Measuring apparatus	Measuring point	Adjustable	Settings and tolerances	Notes
Energy delivered	Joulemeter designed for pulsed biphasic waveforms	Energy display on the Joulemeter after the shock	P1	The value displayed on the Joulemeter must be 180 J ± 2 J	For a discharge at a selected energy of 180 J
High-voltage capacitor voltage measurement signal	VDC digital multimeter	Signal HVMONIT Ref.: GND	P2	Signal HVMONIT must have an amplitude of 4.18 V ± 50 mV	For charge voltage of 4600 V of the high-voltage capacitor (C1 + C2)

8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS




W4P141721 TOP SIDE
ECL01
ECL02
DG501 BIPHASIQUE
Circuit haute tension
Hight voltage circuit
* = pas monter / not mounted
DRAWN
APPROV
MODIFICATION
CK
RH
ECL00 06 / 00
ECL01 02 / 01
ECL02 07 / 01
ART : W1412006
PRT : W4P141721
DGW: W4L141721
SHT : 1/1
SCHILLER

8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS

COMPONENT LIST OF HIGH-VOLTAGE PCB

W4P14 1721

POSITION	ITEM	DESCRIPTION	MANUFACTURER
C1	1994	CAPA CHIMI RAD 100U 63V 10X13	NICHIC
C10	72548	CAPA SMD 1206 47N 50V 5% X7R	VITRAM
C11	21006	CAPA SMD 1206 2.2N 50V 20% X7R	VITRAM
C12	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C13	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C14	72548	CAPA SMD 1206 47N 50V 5% X7R	VITRAM
C15	72548	CAPA SMD 1206 47N 50V 5% X7R	VITRAM
C16	72548	CAPA SMD 1206 47N 50V 5% X7R	VITRAM
C17	72548	CAPA SMD 1206 47N 50V 5% X7R	VITRAM
C18	56394	CAPA SMD TANTAL 10U 35V 10%	SPRAGU
C19	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C2	58245	CAPA CHIMI RAD 3300U 40V 22X25	ROEDER
C20	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C3	72548	CAPA SMD 1206 47N 50V 5% X7R	VITRAM
C4	56394	CAPA SMD TANTAL 10U 35V 10%	SPRAGU
C5	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C6	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C7	20986	CAPA SMD 1206 47P 50V 5% NPO	VITRAM
C8	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C9	20986	CAPA SMD 1206 47P 50V 5% NPO	VITRAM
DN1	51778	DIODE SMD BAV99 SOT23	SIEMEN
DN2	51778	DIODE SMD BAV99 SOT23	SIEMEN
DN3	51778	DIODE SMD BAV99 SOT23	SIEMEN
DN4	51778	DIODE SMD BAV99 SOT23	SIEMEN
DZ1	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ3	39832	DIODE TVS305 5V 300W	MICROS
DZ4	51296	DIODE Z 91V 2W	GENSEM
DZ5	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ6	51775	DIODE Z SMD SOD80 9.1V	PHILIP
D1	51586	DIODE SMD BYD37M SOD87	PHILIP
D10	51586	DIODE SMD BYD37M SOD87	PHILIP
D11	51586	DIODE SMD BYD37M SOD87	PHILIP
D12	51586	DIODE SMD BYD37M SOD87	PHILIP
D13	79073	DIODE SMD MBRS360T3 403-03	MOTORO
D14	22029	DIODE SMD BAS32L SOD80	PHILIP
D15	79073	DIODE SMD MBRS360T3 403-03	MOTORO
D16	11721	DIODE RA 8.5KV 1A	AEG
D17	11721	DIODE RA 8.5KV 1A	AEG
D2	22029	DIODE SMD BAS32L SOD80	PHILIP
D3	51586	DIODE SMD BYD37M SOD87	PHILIP
D4	22029	DIODE SMD BAS32L SOD80	PHILIP
D5	51586	DIODE SMD BYD37M SOD87	PHILIP
D6	51586	DIODE SMD BYD37M SOD87	PHILIP
D7	22029	DIODE SMD BAS32L SOD80	PHILIP
D8	51586	DIODE SMD BYD37M SOD87	PHILIP
D9	51586	DIODE SMD BYD37M SOD87	PHILIP
F1	2259	FUSE GLASS 5X20MM 8A T 250V	WICKMA
F2	35466	FUSE TR5 8X7MM 0.16A T 250V	WICKMA
F3	35008	FUSE TR5 8X7MM 0.5A T 250V	WICKMA
J1	79075	CN M 38 D PRT MILLI-GRID 2.0MM	MOLEX
J10	59995	ACCBL PIN FORK D1.1MM	VOGT

J11	59995	ACCBL PIN FORK D1.1MM	VOGT
J12	35779	ACCBL TAB PL 2.8 PRT	VOGT
J13	59995	ACCBL PIN FORK D1.1MM	VOGT
J14	59995	ACCBL PIN FORK D1.1MM	VOGT
J15	72931	CN F 8 D PRT 4455 PITCH 2.54MM	MOLEX
J16	35779	ACCBL TAB PL 2.8 PRT	VOGT
J17	72156	CN M 6 D PRT MODU2	AMP
J18	72972	CN M 34 D PRT MILLI-GRID 2.0MM	MOLEX
J2	59995	ACCBL PIN FORK D1.1MM	VOGT
J3	72143	CN M 34 D PRT GLSS .LONG F/R	AMP
J4	35779	ACCBL TAB PL 2.8 PRT	VOGT
J5	59995	ACCBL PIN FORK D1.1MM	VOGT
J6	72157	CN M 8 D PRT MODU2	AMP
J7	35779	ACCBL TAB PL 2.8 PRT	VOGT
J8	35779	ACCBL TAB PL 2.8 PRT	VOGT
J9	35893	CN F 64 D PRT BARSIL R2.54	RN
PF'1	4915	FUSE SUP PRT 5X20 CLIPS	WICKMA
PF1	4915	FUSE SUP PRT 5X20 CLIPS	WICKMA
PF2	35012	FUSE SUP PRT TR5	WICKMA
PF3	35012	FUSE SUP PRT TR5	WICKMA
P1	34811	RES ADJUST 50K 0.5W 25T V	BOURNS
P1721	W1404691	HV CIRCUIT IC DG501 BIPH	CIRE
P2	34811	RES ADJUST 50K 0.5W 25T V	BOURNS
RG1	452	IC 317/VREG LM317T TO220	STM
RG2	18812	IC 317/VREG LM317LZ TO 92	STM
RL1	51387	RELAY 12V 2XR PRT	KACO
RU1	72932	RES VDR 35V 10% 0.05W R7.5	SIEMEN
R1	72508	RES BOB 27K 5% 10W 20PPM	DALE
R10	20730	RES SMD 332 1% 0.25W 1206	BOURNS
R11	20734	RES SMD 681 1% 0.25W 1206	BOURNS
R12	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R13	51735	RES SMD 20 1% 0.25W 1206	BOURNS
R14	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R15	20743	RES SMD 3.32K 1% 0.25W 1206	BOURNS
R16	51735	RES SMD 20 1% 0.25W 1206	BOURNS
R17	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R18	21347	RES SMD 1M 1% 0.25W 1206	BOURNS
R19	8855	RES SMD 3.01K 1% 0.25W 1206	BOURNS
R2	72507	RES BOB 0.01 3% 3W	DALE
R20	53699	RES SMD 47.5K 1% 0.25W 1206	BOURNS
R21	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R22	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R23	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R24	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R25	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R26	21324	RES SMD 12.1K 1% 0.25W 1206	BOURNS
R27	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R28	20745	RES SMD 4.7K 1% 0.25W 1206	BOURNS
R29	73283	RES SMD 47.5 1% 0.25W 1206	BOURNS
R3	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R30	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R31	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R32	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R33	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R35	21324	RES SMD 12.1K 1% 0.25W 1206	BOURNS
R36	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R37	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R38	20743	RES SMD 3.32K 1% 0.25W 1206	BOURNS
R39	20750	RES SMD 10K 1% 0.25W 1206	BOURNS

R4	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R40	8855	RES SMD 3.01K 1% 0.25W 1206	BOURNS
R41	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R42	56375	RES SMD 511K 1% 0.25W 1206	BOURNS
R43	56375	RES SMD 511K 1% 0.25W 1206	BOURNS
R44	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R45	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R46	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R47	72179	RES MET 40.2M 1% 1W 10000V	PHILIP
R48	72179	RES MET 40.2M 1% 1W 10000V	PHILIP
R49	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R5	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R50	53700	RES SMD 40.2K 1% 0.25W 1206	BOURNS
R51	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R52	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R53	53700	RES SMD 40.2K 1% 0.25W 1206	BOURNS
R54	51745	RES SMD 402K 1% 0.25W 1206	BOURNS
R55	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R56	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R57	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R58	51745	RES SMD 402K 1% 0.25W 1206	BOURNS
R59	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R6	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R60	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R61	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R62	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R63	21325	RES SMD 15K 1% 0.25W 1206	BOURNS
R64	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R65	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R66	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R67	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R68	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R69	1034	RES MET 100K 1% 0.6W 50PPM	DRALOR
R7	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R8	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R9	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
TR1	W1412041	TRANS CONVERTER HT 81869A	OD3100
T1	51298	TRANS IRF540A NMOS TO220	SAMSUN
T10	72912	TRANS IRF4905 S PMOS D2 PAK	IR
T11	72925	TRANS SMD PMOS IRFL9014 SOT223	IR
T12	72923	TRANS SMD NMOS IRLL014 SOT223	IR
T13	72923	TRANS SMD NMOS IRLL014 SOT223	IR
T14	51777	TRANS SMD BC860C PNP SOT23	SIEMEN
T15	51777	TRANS SMD BC860C PNP SOT23	SIEMEN
T2	51298	TRANS IRF540A NMOS TO220	SAMSUN
T3	72923	TRANS SMD NMOS IRLL014 SOT223	IR
T4	51777	TRANS SMD BC860C PNP SOT23	SIEMEN
T5	72925	TRANS SMD PMOS IRFL9014 SOT223	IR
T6	51777	TRANS SMD BC860C PNP SOT23	SIEMEN
T7	51779	TRANS SMD BC850C NPN SOT23	MOTORO
T8	51777	TRANS SMD BC860C PNP SOT23	SIEMEN
T9	51777	TRANS SMD BC860C PNP SOT23	SIEMEN
U1	79077	IC 4427/DRV TC4427 COA SO8 SMD	TELCOM
U2	79077	IC 4427/DRV TC4427 COA SO8 SMD	TELCOM
U3	33924	IC 358A/OP LM358AM SO8 SMD	NS
U4	72611	IC 2843/PWM UC2843AD SO14	MOTORO
U5	69958	IC 2272 /TLC2272CD SMD SO8	TI
	2567	EFX NUT HU M3 ACNI	BOSSAR
	35776	ACCBL SLVE CLIP FASTON 2.8	VOGT

	11588	EFX WASHR VENT M3 INX A2	BOSSAR
	58061	RADIAT TO218	THERMA
	1708	EFX SCRW TCB CROSS-HEAD M3X8 ACNI	BOSSAR
	35965	ACCBL DUCT THERMO B-EX 480	SES
	76015	RADIAT TO220 PRT V	THERMA
	35772	ACCBL CLIP FASTON 2.8 0.3-0.6	VOGT

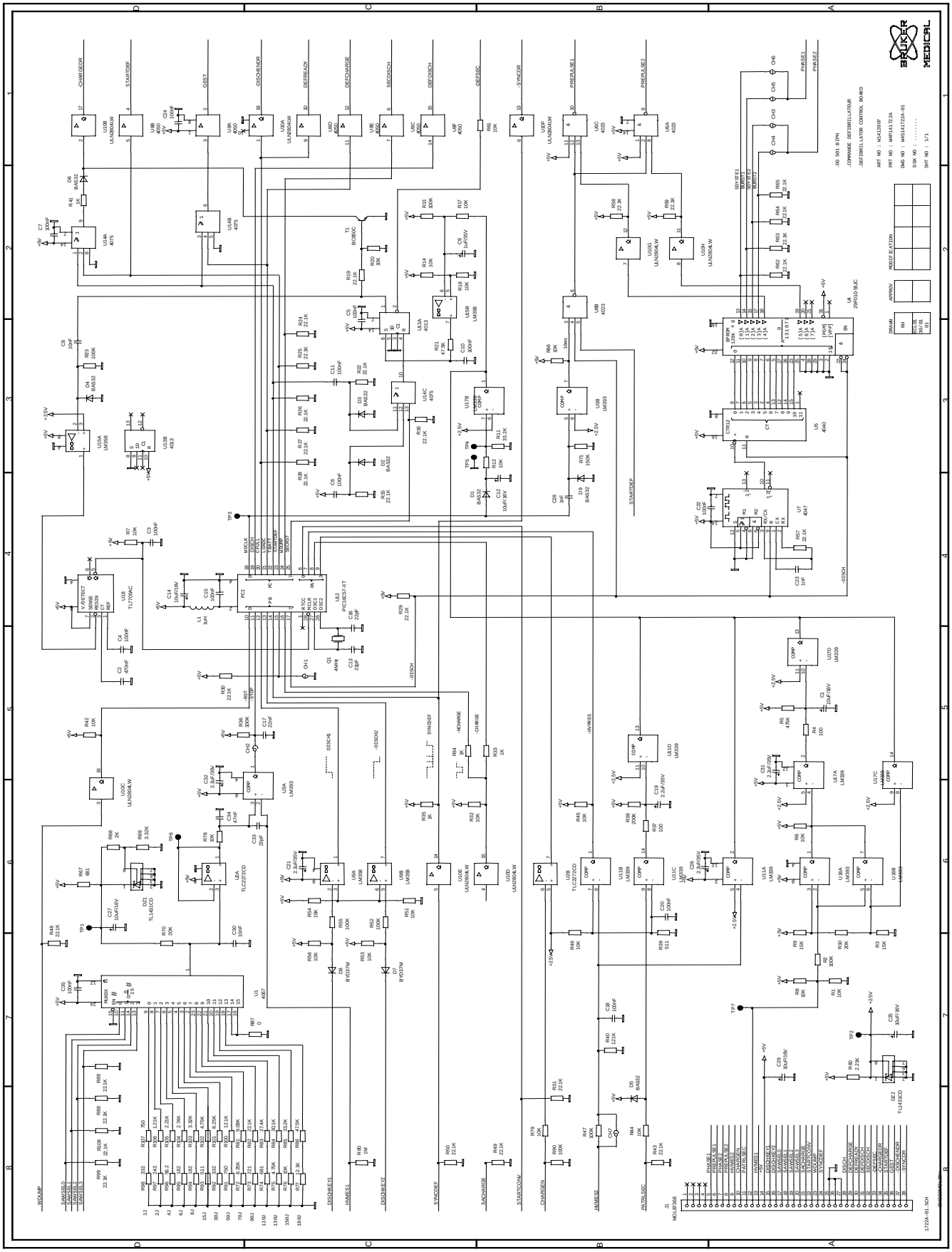
8.15. DEFIBRILLATOR CONTROL PRINTED CIRCUIT BOARD

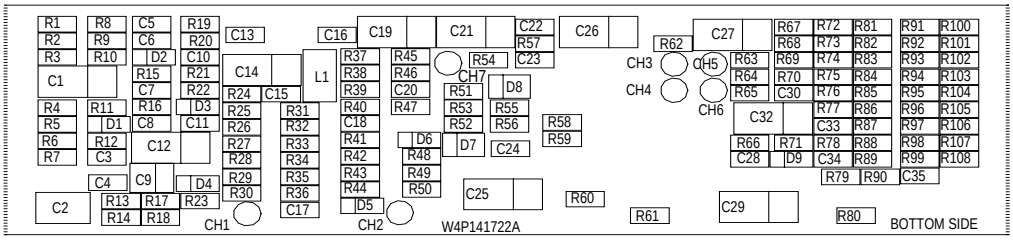
Article no.: **W141 2007**

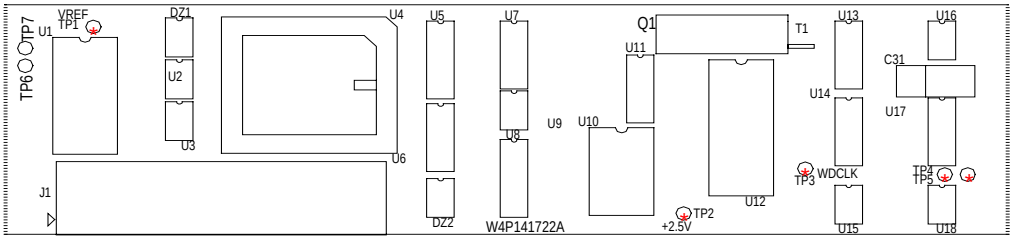
Description: **DEFIBRILLATOR CONTROL PCB**

Reference: **W4P14 1722**
W4P14 1722A

8. COMPONENT LISTS, DRAWINGS AND DIAGRAMS







* = pas monté / *not monted*

DEFIGARD 501
Commande défibrillateur
Defibrillator control

DRAWN	APPROV	MODIFICATION
RC	RH	
ECL01 10/ 00	ECL01 10/ 00	

ART : W1412007
PRT : W4P141722A
DGW : W4L141722A
SHT : 1/1

BRUKER MEDICAL

COMPONENT LIST OF DEFIBRILLATOR CONTROL PCB

W4P14 1722A

POSITION	ITEM	DESCRIPTION	MANUFACTURER
C1	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C10	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C11	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C12	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C13	20982	CAPA SMD 1206 22P 50V 5% NPO	VITRAM
C14	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C15	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C16	20982	CAPA SMD 1206 22P 50V 5% NPO	VITRAM
C17	21018	CAPA SMD 1206 22N 50V 10% X7R	VITRAM
C18	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C19	72541	CAPA SMD TANTAL 2.2U 35V 20%	SPRAGU
C2	22597	CAPA SMD 1812 470N 50V 20% X7R	VITRAM
C20	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C21	72541	CAPA SMD TANTAL 2.2U 35V 20%	SPRAGU
C22	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C23	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C24	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C25	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C26	72541	CAPA SMD TANTAL 2.2U 35V 20%	SPRAGU
C27	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C28	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C29	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C3	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C30	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C31	72541	CAPA SMD TANTAL 2.2U 35V 20%	SPRAGU
C32	72541	CAPA SMD TANTAL 2.2U 35V 20%	SPRAGU
C33	20982	CAPA SMD 1206 22P 50V 5% NPO	VITRAM
C34	72548	CAPA SMD 1206 47N 50V 5% X7R	VITRAM
C35	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C4	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C5	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C6	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C7	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C8	21014	CAPA SMD 1206 10N 50V 20% X7R	VITRAM
C9	72543	CAPA SMD TANTAL 1U 35V 20%	SPRAGU
D1	22029	DIODE SMD BAS32L SOD80	PHILIP
D2	22029	DIODE SMD BAS32L SOD80	PHILIP
D3	22029	DIODE SMD BAS32L SOD80	PHILIP
D4	22029	DIODE SMD BAS32L SOD80	PHILIP
D5	22029	DIODE SMD BAS32L SOD80	PHILIP
D6	22029	DIODE SMD BAS32L SOD80	PHILIP
D7	51586	DIODE SMD BYD37M SOD87	PHILIP
D8	51586	DIODE SMD BYD37M SOD87	PHILIP
D9	22029	DIODE SMD BAS32L SOD80	PHILIP
DZ1	72503	IC 1431/VREF TL1431CD SO8	TI
DZ2	72503	IC 1431/VREF TL1431CD SO8	TI
J1	79074	CN F 38 C MILLI-GRID SMD	MOLEX
L1	79076	SELF SMD BDS3/3/4.6-3S1	PHILIP
P1722	W1404692	DEF CONTROL IC DG501 BIPH	SACEL
Q1	79082	QUARTZ 4MHZ SMLB	SARONI
R1	20750	RES SMD 10K 1% 0.25W 1206	BOURNS

R10	33927	RES SMD 20K 1% 0.25W 1206	BOURNS
R100	21324	RES SMD 12.1K 1% 0.25W 1206	BOURNS
R101	20748	RES SMD 8.25K 1% 0.25W 1206	BOURNS
R102	20745	RES SMD 4.7K 1% 0.25W 1206	BOURNS
R103	20743	RES SMD 3.32K 1% 0.25W 1206	BOURNS
R104	20742	RES SMD 2.7K 1% 0.25W 1206	BOURNS
R105	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R106	20738	RES SMD 1.21K 1% 0.25W 1206	BOURNS
R107	51516	RES SMD 750 1% 0.25W 1206	BOURNS
R108	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R11	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R12	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R13	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R14	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R15	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R16	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R17	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R18	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R19	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R2	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R20	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R21	53699	RES SMD 47.5K 1% 0.25W 1206	BOURNS
R22	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R23	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R24	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R25	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R26	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R27	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R28	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R29	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R3	21325	RES SMD 15K 1% 0.25W 1206	BOURNS
R30	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R31	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R32	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R33	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R34	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R35	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R36	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R37	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R38	51736	RES SMD 200K 1% 0.25W 1206	BOURNS
R39	59889	RES SMD 511 1% 0.25W 1206	BOURNS
R4	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R40	21336	RES SMD 121K 1% 0.25W 1206	BOURNS
R41	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R42	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R43	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R44	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R45	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R46	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R47	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R48	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R49	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R5	51748	RES SMD 475K 1% 0.25W 1206	BOURNS
R50	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R51	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R52	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R53	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R54	21325	RES SMD 15K 1% 0.25W 1206	BOURNS
R55	21335	RES SMD 100K 1% 0.25W 1206	BOURNS

R56	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R57	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R58	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R59	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R6	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R60	20741	RES SMD 2.21K 1% 0.25W 1206	BOURNS
R61	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R62	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R63	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R64	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R65	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R66	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R67	20734	RES SMD 681 1% 0.25W 1206	BOURNS
R68	51734	RES SMD 2K 1% 0.25W 1206	BOURNS
R69	20743	RES SMD 3.32K 1% 0.25W 1206	BOURNS
R7	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R70	33927	RES SMD 20K 1% 0.25W 1206	BOURNS
R71	21337	RES SMD 150K 1% 0.25W 1206	BOURNS
R72	20748	RES SMD 8.25K 1% 0.25W 1206	BOURNS
R73	20728	RES SMD 221 1% 0.25W 1206	BOURNS
R74	20734	RES SMD 681 1% 0.25W 1206	BOURNS
R75	20745	RES SMD 4.7K 1% 0.25W 1206	BOURNS
R76	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R77	21324	RES SMD 12.1K 1% 0.25W 1206	BOURNS
R78	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R79	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R8	20750	RES SMD 10K 1% 0.25W 1206	BOURNS
R80	21347	RES SMD 1M 1% 0.25W 1206	BOURNS
R81	20749	RES SMD 9.09K 1% 0.25W 1206	BOURNS
R82	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R83	53691	RES SMD 27.4K 1% 0.25W 1206	BOURNS
R84	53702	RES SMD 30.1K 1% 0.25W 1206	BOURNS
R85	21329	RES SMD 33.2K 1% 0.25W 1206	BOURNS
R86	53699	RES SMD 47.5K 1% 0.25W 1206	BOURNS
R87	21352	RES SMD 0 5% 0.25W 1206	BOURNS
R88	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R89	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R9	21325	RES SMD 15K 1% 0.25W 1206	BOURNS
R90	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R91	51516	RES SMD 750 1% 0.25W 1206	BOURNS
R92	20730	RES SMD 332 1% 0.25W 1206	BOURNS
R93	59889	RES SMD 511 1% 0.25W 1206	BOURNS
R94	20727	RES SMD 182 1% 0.25W 1206	BOURNS
R95	20727	RES SMD 182 1% 0.25W 1206	BOURNS
R96	20720	RES SMD 56.2 1% 0.25W 1206	BOURNS
R97	51286	RES SMD 243 1% 0.25W 1206	BOURNS
R98	20730	RES SMD 332 1% 0.25W 1206	BOURNS
R99	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
S4	72935	IC SUPPORT PLCC32 SMD	AMP
T1	51779	TRANS SMD BC850C NPN SOT23	MOTORO
U1	51579	IC 4067/MUX HEF4067BT SO24L	PHILIP
U10	22492	IC 62084/TD62084AF SOL18	TOSHIB
U11	51943	IC 339/OP LM339M SO14 SMD	NS
U12	W1405021	PG ODAM 501 DEF CTRL	PIGE
U13	51802	IC 4013/CD HEF4013BT SO14 SMD	PHILIP
U14	51801	IC 4075/CD HEF4075BT SO14 SMD	PHILIP
U15	33924	IC 358A/OP LM358AM SO8 SMD	NS
U16	51804	IC 393/OP LM393M SO8 SMD	NS
U17	51943	IC 339/OP LM339M SO14 SMD	NS

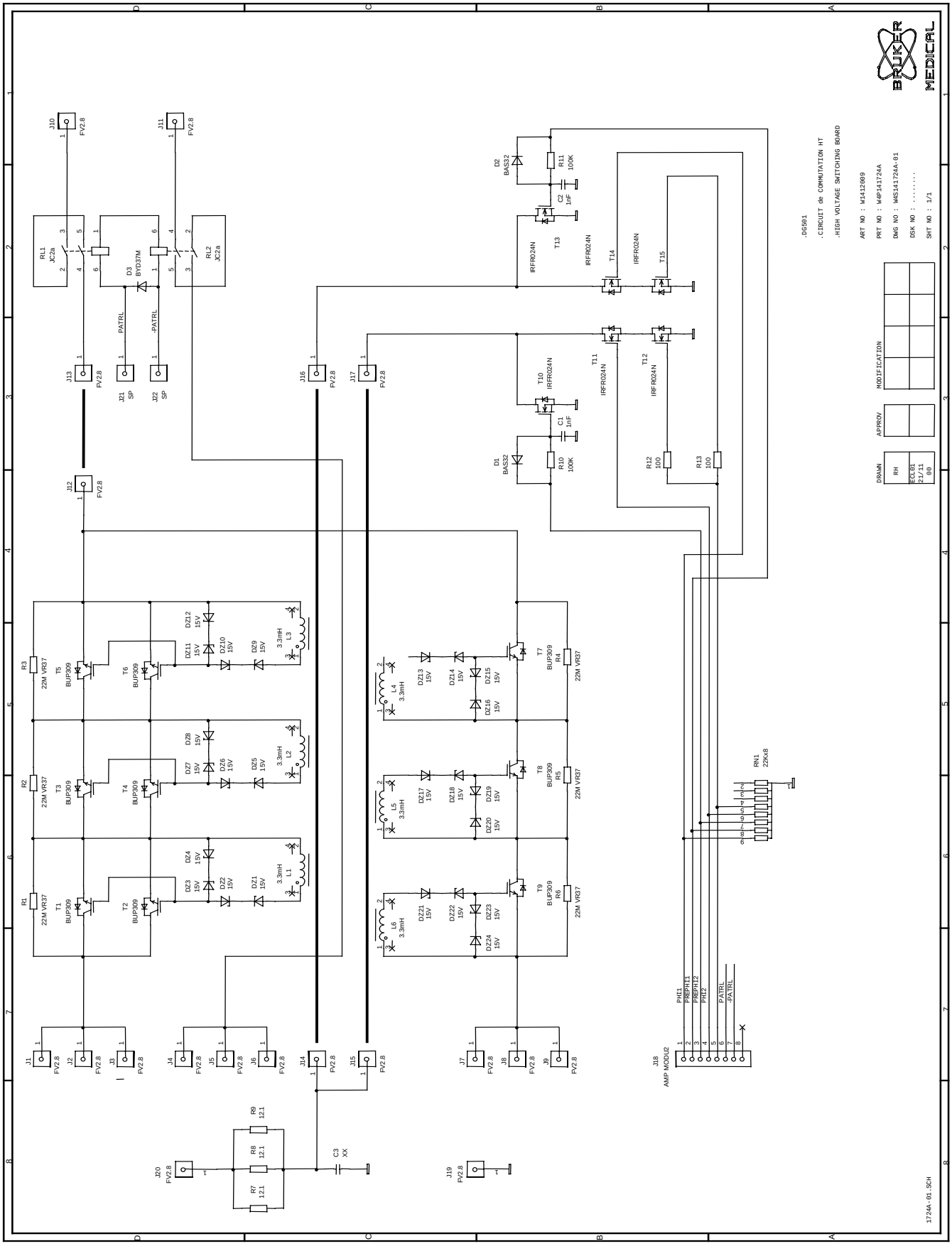
U18	51535	IC 7705/TL7705ACD SO8 SMD	TI
U2	69958	IC 2272 /TLC2272CD SMD SO8	TI
U3	51804	IC 393/OP LM393M SO8 SMD	NS
U4	W1405391	PG ODAM 501 PULSE BIPH	OD3200
U5	51494	IC 4040/CD HEF4040BT SO16 SMD	PHILIP
U6	51800	IC 4023/CD HEF4023BT SO14 SMD	PHILIP
U7	51796	IC 4047/CD HEF4047BT SO14 SMD	PHILIP
U8	51798	IC 4050/CD HEF4050BT SO16 SMD	PHILIP
U9	33924	IC 358A/OP LM358AM SO8 SMD	NS

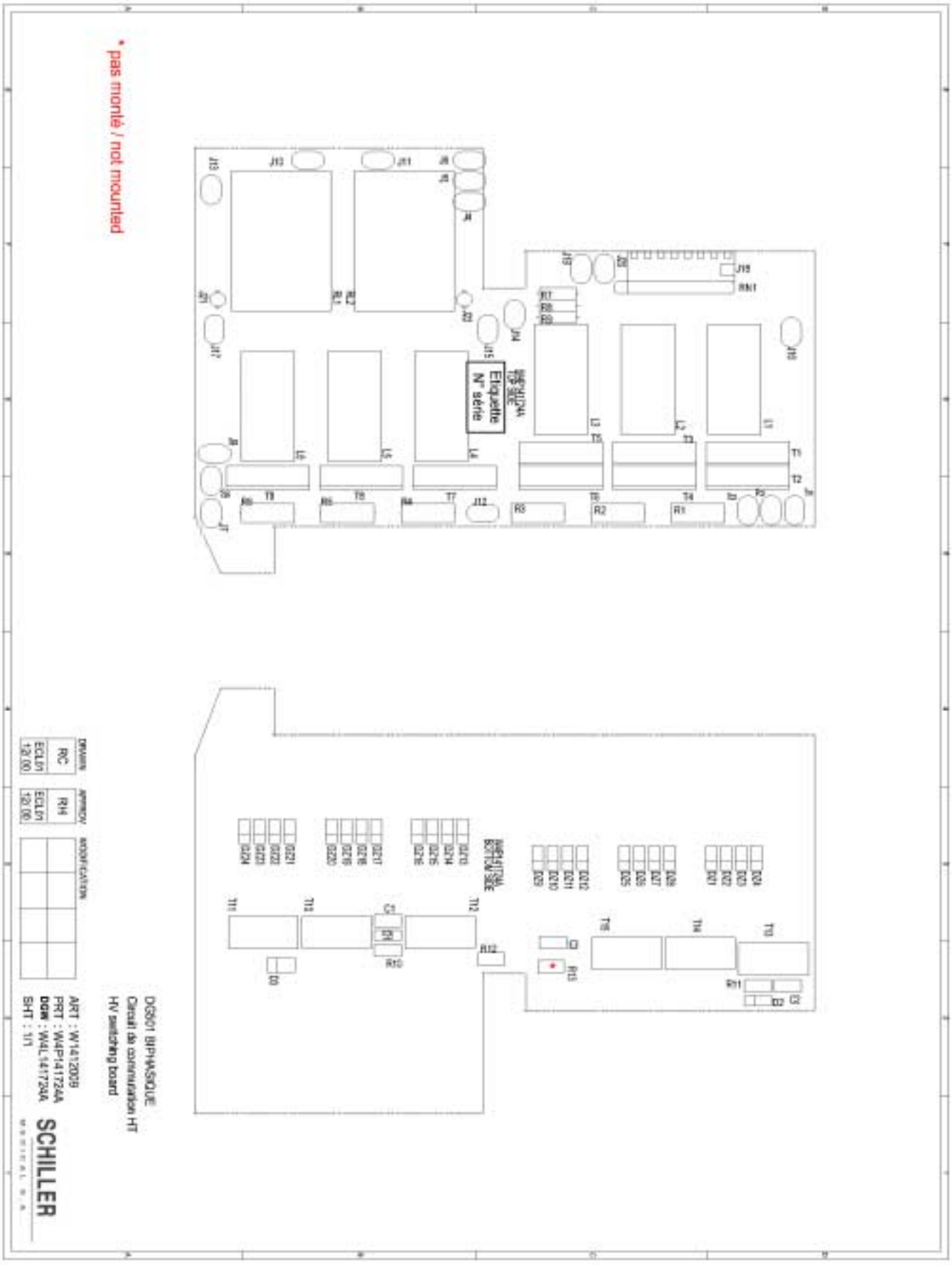
8.16. HIGH-VOLTAGE SWITCHING CIRCUIT BOARD

Article no.: **W141 2009**

Description: **HIGH-VOLTAGE SWITCHING PCB**

Reference: **W4P14 1724**
W4P14 1724A


BRUKER MEDICAL
.DG501
.CIRCUIT de COMMUTATION HT
.HIGH VOLTAGE SWITCHING BOARD
ART NO : W14412009
PRT NO : W4P1417244
DWG NO : W4S1417244-01
DSK NO : ....
SHT NO : 1/1
MODIFICATION
APPROV
DRAWN
RH
ECL01
21/11
00
1724A-01.SCH


* pas monté / not mounted
DESSIN
RIC
EGLO1
12.00
APPROV
RH
EGLO1
12.00
MODIFICATION
DG501 BIPHASIQUE
Circuit de commutation HT
HV switching board
ART : W1412009
PRT : W4P141724A
DGM : W4L141724A
SHT : 1/1
SCHILLER

COMPONENT LIST OF HIGH-VOLTAGE SWITCHING PCB

W4P14 1724A

POSITION	ITEM	DESCRIPTION	MANUFACTURER
C1	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
C2	21002	CAPA SMD 1206 1N 50V 5% NPO	VITRAM
CBL1	W1412032	IGBT CTRL CABLE	OD2100
CBL2	W1412032	IGBT CTRL CABLE	OD2100
D1	22029	DIODE SMD BAS32L SOD80	PHILIP
D2	22029	DIODE SMD BAS32L SOD80	PHILIP
D3	51586	DIODE SMD BYD37M SOD87	PHILIP
DZ1	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ10	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ11	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ12	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ13	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ14	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ15	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ16	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ17	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ18	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ19	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ2	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ20	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ21	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ22	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ23	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ24	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ3	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ4	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ5	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ6	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ7	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ8	72933	DIODE Z SMD SOD80C 15V	PHILIP
DZ9	72933	DIODE Z SMD SOD80C 15V	PHILIP
J1	35779	ACCBL TAB PL 2.8 PRT	VOGT
J10	35779	ACCBL TAB PL 2.8 PRT	VOGT
J11	35779	ACCBL TAB PL 2.8 PRT	VOGT
J12	35779	ACCBL TAB PL 2.8 PRT	VOGT
J13	35779	ACCBL TAB PL 2.8 PRT	VOGT
J14	35779	ACCBL TAB PL 2.8 PRT	VOGT
J15	35779	ACCBL TAB PL 2.8 PRT	VOGT
J16	35779	ACCBL TAB PL 2.8 PRT	VOGT
J17	35779	ACCBL TAB PL 2.8 PRT	VOGT
J18	72157	CN M 8 D PRT MODU2	AMP
J19	35779	ACCBL TAB PL 2.8 PRT	VOGT
J2	35779	ACCBL TAB PL 2.8 PRT	VOGT
J20	35779	ACCBL TAB PL 2.8 PRT	VOGT
J21	59995	ACCBL PIN FORK D1.1MM	VOGT
J22	59995	ACCBL PIN FORK D1.1MM	VOGT
J3	35779	ACCBL TAB PL 2.8 PRT	VOGT
J4	35779	ACCBL TAB PL 2.8 PRT	VOGT
J5	35779	ACCBL TAB PL 2.8 PRT	VOGT
J6	35779	ACCBL TAB PL 2.8 PRT	VOGT
J7	35779	ACCBL TAB PL 2.8 PRT	VOGT

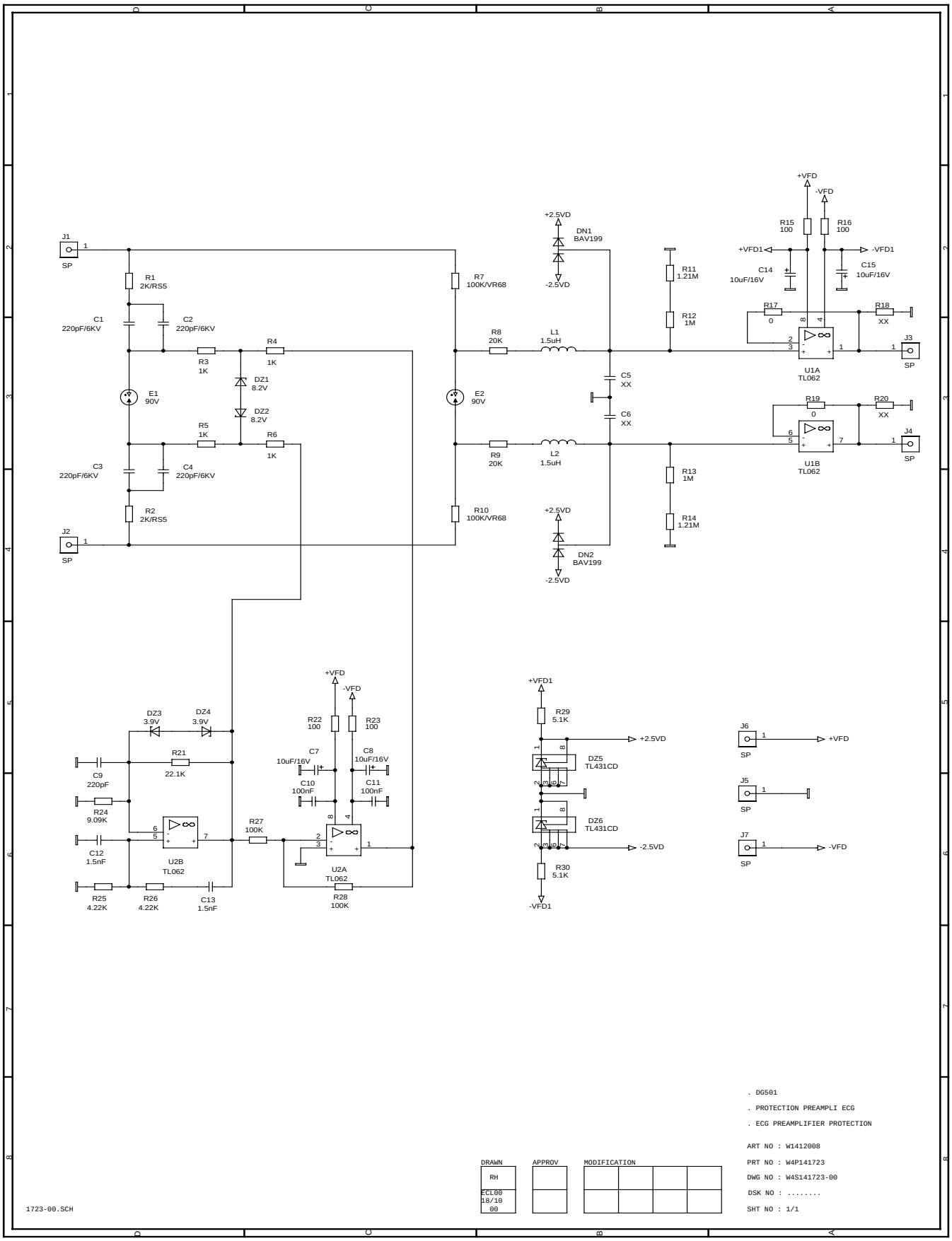
J8	35779	ACCBL TAB PL 2.8 PRT	VOGT
J9	35779	ACCBL TAB PL 2.8 PRT	VOGT
L1	W1405334	TRANS CORE DIAM 16.5	CECLA
L2	W1405334	TRANS CORE DIAM 16.5	CECLA
L3	W1405334	TRANS CORE DIAM 16.5	CECLA
L4	W1405334	TRANS CORE DIAM 16.5	CECLA
L5	W1405334	TRANS CORE DIAM 16.5	CECLA
L6	W1405334	TRANS CORE DIAM 16.5	CECLA
P1724A	W1404694	HV SWITCHING IC DG501 BIPH	WUERTH
R1	51164	RES MET 22M 5% 0.5W 2500V	PHILIP
R10	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R11	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R12	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R13	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R2	51164	RES MET 22M 5% 0.5W 2500V	PHILIP
R3	51164	RES MET 22M 5% 0.5W 2500V	PHILIP
R4	51164	RES MET 22M 5% 0.5W 2500V	PHILIP
R5	51164	RES MET 22M 5% 0.5W 2500V	PHILIP
R6	51164	RES MET 22M 5% 0.5W 2500V	PHILIP
R7	987	RES MET 12.1 1% 0.6W 50PMM	DRALOR
R8	987	RES MET 12.1 1% 0.6W 50PMM	DRALOR
R9	987	RES MET 12.1 1% 0.6W 50PMM	DRALOR
RL1	79072	RELAY 6V 1XT PRT	NAIS
RL2	79072	RELAY 6V 1XT PRT	NAIS
RN1	577	RES RES 22KX8 2% SIL9	BOURNS
T1	79070	TRANS BUP309 IGBT TO218AB	SIEMEN
T10	51364	TRANS SMD IRFR024N TR	IR
T11	51364	TRANS SMD IRFR024N TR	IR
T12	51364	TRANS SMD IRFR024N TR	IR
T13	51364	TRANS SMD IRFR024N TR	IR
T14	51364	TRANS SMD IRFR024N TR	IR
T15	51364	TRANS SMD IRFR024N TR	IR
T2	79070	TRANS BUP309 IGBT TO218AB	SIEMEN
T3	79070	TRANS BUP309 IGBT TO218AB	SIEMEN
T4	79070	TRANS BUP309 IGBT TO218AB	SIEMEN
T5	79070	TRANS BUP309 IGBT TO218AB	SIEMEN
T6	79070	TRANS BUP309 IGBT TO218AB	SIEMEN
T7	79070	TRANS BUP309 IGBT TO218AB	SIEMEN
T8	79070	TRANS BUP309 IGBT TO218AB	SIEMEN
T9	79070	TRANS BUP309 IGBT TO218AB	SIEMEN

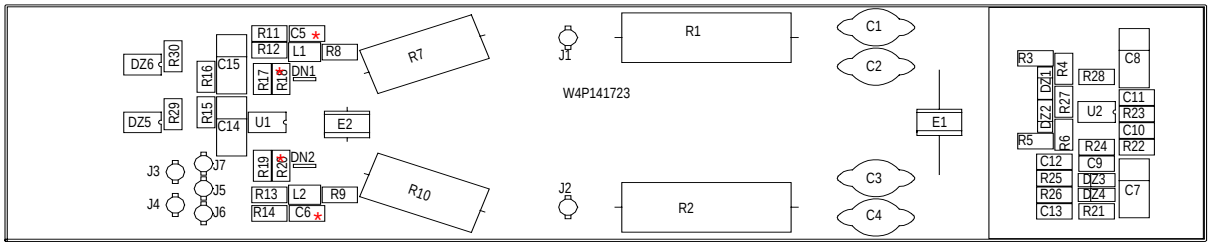
8.17. ECG PREAMP PROTECTION PRINTED CIRCUIT BOARD

Article no.: **W141 2008**

Description: **ECG PREAMP PROTECT PCB**

Reference: **W4P14 1723**


J1
SP
R1
2K/RS5
C1
220pF/6KV
C2
220pF/6KV
R3
1K
R4
1K
DZ1
8.2V
DZ2
8.2V
E1
90V
R5
1K
R6
1K
C3
220pF/6KV
C4
220pF/6KV
R2
2K/RS5
J2
SP
R7
100K/VR68
R8
20K
L1
1.5uH
E2
90V
R9
20K
L2
1.5uH
R10
100K/VR68
DN1
BAV199
DN2
BAV199
+2.5VD
-2.5VD
C5
XX
C6
XX
R11
1.21M
R12
1M
R13
1M
R14
1.21M
+VFD
-VFD
R15
100
R16
100
+VFD1
-VFD1
C14
10uF/16V
C15
10uF/16V
R17
0
R18
XX
U1A
TL062
J3
SP
R19
0
R20
XX
U1B
TL062
J4
SP
DZ3
3.9V
DZ4
3.9V
R21
22.1K
C9
220pF
R24
9.09K
C12
1.5nF
U2B
TL062
R25
4.22K
R26
4.22K
C13
1.5nF
R22
100
R23
100
C7
10uF/16V
C8
10uF/16V
C10
100nF
C11
100nF
R27
100K
U2A
TL062
R28
100K
R29
5.1K
DZ5
TL431CD
DZ6
TL431CD
R30
5.1K
J6
SP
J5
SP
J7
SP
. DG501
. PROTECTION PREAMPLI ECG
. ECG PREAMPLIFIER PROTECTION
ART NO : W1412008
PRT NO : W4P141723
DWG NO : W4S141723-00
DSK NO : .....
SHT NO : 1/1
DRAWN
RH
ECL00
18/10
00
APPROV
MODIFICATION
1723-00.SCH



* pas monté / not monted

DG501 BIPHASIQUE
Protection préampli ECG
ECG preamplifier protection

DRAWN	APPROV	MODIFICATION
RC	RH	
07/ 00	07/ 00	

ART : W1412008
PRT : W4P141723
DGW : W4L141723
SHT : 1/1

SCHILLER MEDICAL S.A.

COMPONENT LIST OF ECG PREAMP PROTECTION PCB

W4P14 1723

POSITION	ITEM	DESCRIPTION	MANUFACTURER
C1	72651	CAPA CERDI 220PF 6KV R12.5	ROEDER
C10	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C11	8493	CAPA SMD 1206 100N 50V 20% X7R	VITRAM
C12	21004	CAPA SMD 1206 1.5N 50V 5% NPO	VITRAM
C13	21004	CAPA SMD 1206 1.5N 50V 5% NPO	VITRAM
C14	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C15	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C2	72651	CAPA CERDI 220PF 6KV R12.5	ROEDER
C3	72651	CAPA CERDI 220PF 6KV R12.5	ROEDER
C4	72651	CAPA CERDI 220PF 6KV R12.5	ROEDER
C7	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C8	51559	CAPA SMD TANTAL 10U 16V 10%	SPRAGU
C9	20994	CAPA SMD 1206 220P 50V 5% NPO	VITRAM
CBL1	W1411834	CONNECTING CABLE PREAMP/PREAMP PROTEC	W2652
CBL2	W1412042	CBL WIRE ORG 1 FASTON 2.8-195MM	OD3100
CBL3	W1412043	CBL WIRE BC 1 FASTON 2.8-195MM	OD3100
DN1	72501	DIODE SMD BAV199 SOT23	SIEMEN
DN2	72501	DIODE SMD BAV199 SOT23	SIEMEN
DZ1	51774	DIODE Z SMD SOD80 8.2V	PHILIP
DZ2	51774	DIODE Z SMD SOD80 8.2V	PHILIP
DZ3	72245	DIODE Z SMD SOD80 3.9V	PHILIP
DZ4	72245	DIODE Z SMD SOD80 3.9V	PHILIP
DZ5	51832	IC 431/VREF TL431CD SO8 SMD	TI
DZ6	51832	IC 431/VREF TL431CD SO8 SMD	TI
E1	34883	SPARKER FUSE	SIEMEN
E2	34883	SPARKER FUSE	SIEMEN
J1	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
J2	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
J3	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
J4	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
J5	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
J6	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
J7	21456	ACCBL PIN FORK PRT 1.0MM	VOGT
L1	22874	SELF SMD 1008 1.5UH 10%	COILCR
L2	22874	SELF SMD 1008 1.5UH 10%	COILCR
P1723	W1404693	CI PROT PREAMP ECG DG501 BIPH	WUERTH
R1	72637	RES BOB 2K 1% 5W 20PPM	DALE
R10	72917	RES HT 100K 1%	PHILIP
R11	21348	RES SMD 1.21M 1% 0.25W 1206	BOURNS
R12	21347	RES SMD 1M 1% 0.25W 1206	BOURNS
R13	21347	RES SMD 1M 1% 0.25W 1206	BOURNS
R14	21348	RES SMD 1.21M 1% 0.25W 1206	BOURNS
R15	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R16	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R17	21352	RES SMD 0 5% 0.25W 1206	BOURNS
R19	21352	RES SMD 0 5% 0.25W 1206	BOURNS
R2	72637	RES BOB 2K 1% 5W 20PPM	DALE
R21	21327	RES SMD 22.1K 1% 0.25W 1206	BOURNS
R22	20724	RES SMD 100 1% 0.25W 1206	BOURNS
R23	20724	RES SMD 100 1% 0.25W 1206	BOURNS

R24	20749	RES SMD 9.09K 1% 0.25W 1206	BOURNS
R25	51291	RES SMD 4.22K 1% 0.25W 1206	BOURNS
R26	51291	RES SMD 4.22K 1% 0.25W 1206	BOURNS
R27	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R28	21335	RES SMD 100K 1% 0.25W 1206	BOURNS
R29	59887	RES SMD 5.11K 1% 0.25W 1206	BOURNS
R3	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R30	59887	RES SMD 5.11K 1% 0.25W 1206	BOURNS
R4	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R5	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R6	20737	RES SMD 1K 1% 0.25W 1206	BOURNS
R7	72917	RES HT 100K 1%	PHILIP
R8	33927	RES SMD 20K 1% 0.25W 1206	BOURNS
R9	33927	RES SMD 20K 1% 0.25W 1206	BOURNS
U1	51675	IC 062/OP TL062CD SO8 SMD	TI
U2	51675	IC 062/OP TL062CD SO8 SMD	TI
	3632	ACCBL CABLE CLAMP 2.5X89MM	PANDUI

9. INDEX