

DEFIBRILLATION SAFETY

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Executive Summary

In the past years, there has been a dramatic transition between the use of older monophasic defibrillators to newer, more sophisticated, biphasic types. As these biphasic defibrillators are more efficient, they require less energy and therefore create less of a risk to bystanders. Due to the lack of research around these new defibrillators, the current recommended procedures may not accurately reflect the safety of medical personnel. Because of this, the recommended “all clear” period may in fact become detrimental to the health of the patient as it causes the cessation of crucial activities of medical staff such as IV canalization and chest compressions. This thesis is aimed at assisting in a study to be performed by the Professor of Emergency Medicine at Royal Perth Hospital by designing a device capable of measuring, storing and analyzing the leakage voltages from a patient and their environment whilst undergoing defibrillation.

The device that was designed consisted of a data acquisition system that would measure the voltages using standard ECG leads, and then wirelessly transmit that data to a laptop for further processing. Throughout the entire design process, the focus was aimed at ensuring the device would meet all the criteria specified in the required standards and cause no detrimental effect to the patient being monitored. At the end of the thesis period, a functional schematic was designed and tested, ready for manufacture as well as a solid framework of the software component of the project.

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Terminology and Acronyms

AED – Automated External Defibrillator

AHA – American Heart Association

BMI – Body Mass Index

BOM – Bill of Materials

CAD – Computer Aided Design

CMRR – Common Mode Rejection Ratio

COTS – Commercial off the shelf

CTI – Comparative Track Index

DAQ – Data Acquisition

ECG – Electrocardiogram

ED – Emergency Department

ERC – European Resuscitation Council

GDT – Gas Discharge Tube

GMP – Good Manufacturing Practice

GUI – Graphical User Interface

IC – Integrated Circuit

IP (Rating) – Ingress Protection

IP (address) – Internet Protocol

IV - Intravenous

LED – Light Emitting Diode

(MOS)FET – Metal-oxide-semiconductor Field-effect Transistor

PCB – Printed Circuit Board

RMS – Root Mean Squared

RPH – Royal Perth Hospital

SQL – Structured Query Language

TGA – Therapeutic Goods Administration

TVS – Transient Voltage Suppressor

UMRN – Unique/Unit Medical Record Number