



User/Operator Manual

English

Part number:
41-3007EN-04

Date of issue:
2024-10-14

Tempus LS-Manual

Defibrillator

PHILIPS

This document contains legally protected information. All rights reserved. Copying in mechanical, electronic and any other form without the written approval of the manufacturer is prohibited.

Copyright © 2024
Koninklijke Philips N.V

Manufacturer's address

Tempus LS-Manual is distributed by Remote Diagnostic Technologies Limited.

Remote Diagnostic Technologies Limited
Ascent 1,
Farnborough Aerospace Centre
Aerospace Boulevard
Farnborough
Hampshire
GU14 6XW
UK

Tel +44 (0) 1256 362 400
www.philips.com



The Tempus LS-Manual is manufactured by:

SCHILLER AG
Altgasse 68
CH-6341 Baar, Switzerland

Tel +41 (0) 41 766 42 42
Fax +41 (0) 041 761 08 08
Web: www.schiller.ch

This manual is valid for software 1.3.4 or newer

If any serious incident has occurred in relation to the device it should be reported to Remote Diagnostic Technologies Limited and the competent authority of the Member State in which the user and/or patient is established.

Table of Contents

Chapter 1

Introduction.....	7
1.1 General safety notes	8
1.1.1 Intended use/user profiles	8
1.1.2 Contraindication for use.....	8
1.1.3 Responsibility of the User.....	9
1.1.4 Organizational Measures.....	9
1.1.5 Safety-Conscious Operation.....	10
1.1.6 Operation with other Devices	11
1.1.7 Maintenance	11
1.1.8 Hygiene	12
1.2 Proprietary notice	13
1.2.1 Implied authorization	13
1.2.1.1 Limited warranty.....	13
1.2.1.2 Service support and returns	13
1.3 Display symbols and indicators.....	14
1.3.1 Symbols used in this user guide.....	14
1.3.2 Symbols used on the device.....	15
1.3.3 Symbols used on the battery.....	16
1.3.4 Symbols used on the electrode package.....	17
1.4 Features list.....	18
1.5 Indications for use	19
1.6 Additional statements.....	20

Chapter 2

Getting started	21
2.1 Unpacking the Tempus LS-Manual	22
2.2 Before deployment	23
2.3 Overview of the Tempus LS-Manual	25
2.3.1 Key features of the unit front	25
2.3.2 Back view with battery	25
2.3.3 Socket panel.....	26
2.3.4 LEDs.....	26

2.4 Switching the device on and off	27
2.4.1 Switching the device on.....	27
2.4.2 Switching off and disconnecting from the external supply	27
2.4.3 The tactical mode	27
2.5 New patient	28
2.6 External DC supply and battery operation	29
2.6.1 External DC supply.....	29
2.6.2 Battery operation	30
2.6.3 Interruption of external power supply	32
2.6.4 Isolating from the mains	32
2.7 Ensuring operational readiness.....	33
2.7.1 Ready to use LED	33
2.8 Display of technical alarms and notifications	34
2.8.1 Technical high priority alarms.....	35
2.8.2 Technical notification	36
2.9 Internal safety discharge	38
Chapter 3	
Operation.....	39
3.1 Manual defibrillation	40
3.1.1 Application guidelines and safety notes	40
3.1.2 Defibrillating children/neonates	41
3.1.3 General function	41
3.1.4 Home screen Manual defibrillation mode	42
3.1.5 Initial operation MANUAL (Defibrillation) Mode	44
3.1.6 Manual defibrillation using pads	45
3.1.6.1 Applying the adult and pediatric electrodes	45
3.1.6.2 Applying the electrodes.....	46
3.1.6.3 Manual Defibrillation Using Pads - Procedure	47
3.2 Synchronised defibrillation	48
3.2.1 Warning erroneous triggering	48
3.2.2 Setup switching from unsynchronised to synchronised mode.....	49
3.2.3 Function of the synchronised defibrillation procedure	50
3.2.4 Synchronised defibrillation procedure	51
3.2.5 Finishing the therapy	52
3.3 Pacemaker Function	53
3.3.1 Modes.....	53
3.3.1.1 Fixed-rate mode (Fix).....	53
3.3.1.2 Demand mode	54
3.3.2 Safety notes.....	55
3.3.3 Guidelines for the Application of External Pacemakers.....	56
3.3.3.1 Attaching the pacer pads	56
3.3.4 3 lead ECG setup for Pacemaker.....	57
3.3.5 4 lead ECG setup for Pacemaker.....	57
3.3.6 Start-up of the Pacemaker.....	58
3.3.7 Home screen Pacemaker	59
3.3.8 Initial operation pacemaker	60
3.3.9 Selecting pacemaker mode Fix or Demand	60

3.3.10 Pacemaker settings operational mode Fixed	61
3.3.10.1 Fixed mode	61
3.3.11 Pacemaker settings operational mode Demand.....	62
3.3.12 Pacing automatically stopped.....	62
3.4 CPR.....	63
3.4.1 ARGUS Lifepoint sensor	64
3.4.2 ARGUS Lifepoint measurements	65
3.4.3 Setup of the ARGUS Lifepoint Sensor	66
Chapter 4	
ECG display.....	69
4.1 ECG and heart rate display.....	70
4.1.1 ECG signal with a pacemaker patient	71
4.1.2 ECG signal display with 3 leads (3 wires)	72
4.1.3 ECG signal display with 6 leads (4 wires)	72
4.1.4 Start ECG signal display.....	73
Chapter 5	
System settings	75
5.1 Overview settings.....	76
5.1.1 Overview settings in the operating modes.....	76
5.1.2 User settings manual mode.....	77
5.1.3 User settings Pacer	78
5.1.4 User ECG Settings	78
5.1.5 User Patient Settings.....	78
5.2 System, maintenance and service settings	79
5.2.1 Manual Settings.....	81
5.2.2 Pacer Settings	82
5.2.3 Metronome Settings	82
5.2.4 CPR Feedback Settings	83
5.2.5 Print/Event Settings	83
5.2.6 System Settings.....	84
5.2.7 Default settings storage.....	86
5.2.8 Log file export.....	87
Chapter 6	
Daily checks and Maintenance.....	89
6.1 Daily check and Maintenance interval	90
6.1.1 Maintenance interval table.....	90
6.1.2 Service/Shelf life.....	91
6.2 Functional test.....	92
6.2.1 Visual inspection of the device and accessories	92
6.2.2 Self tests.....	92
6.2.3 Battery check.....	93
6.2.4 Defibrillator keys and alarm test	94
6.2.5 Defibrillation test	94
6.2.6 ECG display test.....	95
6.2.7 Pacemaker and ECG lead test.....	95

6.3 Maintenance interval of the batteries	97
6.3.1 Replacing the batteries.....	98
6.3.2 Battery disposal	98
6.4 External servicing.....	99
6.4.1 Handle replacement	99
6.4.2 Battery cover replacement.....	100
6.4.3 Dust cover fitting/replacement.....	101
6.4.4 Rear clip replacement.....	102
6.4.5 Wear parts	103
6.5 Cleaning	104
6.5.1 Cleaning agents.....	104
6.5.2 Cleaning the device and ECG patient cable and CPR Sensor.....	105
6.5.3 Check and cleaning the battery contacts.....	106
6.5.4 Disposal at the end of the device's useful life.....	106
6.6 Inspection and checklist tables	107
6.6.1 Every 12 months.....	107
6.6.2 Limited life item replacement every 5 - 10 years	108
6.7 Error detection	109
6.7.1 General errors & troubleshooting	109
6.7.2 Technical alarms, notifications	110
6.8 Preventing electromagnetic interferences.....	112
6.8.1 Measures to prevent electromagnetic interference	113
6.9 Accessories and disposables.....	114
6.9.1 Accessories Tempus LS-Manual	114
Chapter 7	
Specification and standards.....	115
7.1 Physical characteristics and environmental specifications.....	116
7.2 Standards.....	118
7.3 Defibrillation	119
7.4 Pacemaker	121
7.5 ECG signal display.....	122
7.6 Electromagnetic interference	123
7.6.1 Electromagnetic emissions.....	123
7.6.2 Electromagnetic immunity	124
7.6.3 Immunity to proximity fields from RF wireless communications equipment	127
7.6.4 Recommended separation distances	128
7.7 Bluetooth standard	129
7.8 CPR Sensor	129
Chapter 8	
Pairing with Tempus Pro.....	131
8.1 Pairing Tempus Pro with Tempus LS-Manual	132
8.2 Using the TDL link.....	133
8.3 Using the connected units on different patients	134
8.4 Tempus LS-Manual event capture.....	135

Chapter 1

Introduction

The Tempus LS-Manual defibrillator (P/N: 00-3020 / 989706001681, service number: 45356482181) is used for the treatment of ventricular fibrillation (VF) and ventricular tachycardia (VT) in manual defibrillation and a Cardioversion mode to treat atrial fibrillation. The pacemaker module stimulates the heart with two operation modes, “Fix” or “Demand”. As an option, CPR assistance is available with the CPR Sensor.

The Tempus LS-Manual is a battery-powered, small, lightweight device designed for use in pre-hospital and clinical environments.

Document library

Consult the instruction for use. These are provided in electronic format in the Philips Document library.



www.philips.com/IFU



Important

Please check the Philips Document library regularly for new version of this document.

A paper copy of this document may be requested from Philips Document library or by sending a request to RDT_customerservice@philips.com.

1.1 General safety notes

Caution: Federal law restricts this device to sale by or on the order of a physician.

1.1.1 Intended use/user profiles



- ▲ The **Tempus LS-Manual** is a defibrillator that can deliver a shock in manual or Pacemaker mode with the following feature:
 - CPR Feedback sensor
- ▲ In addition, the ECG signal of the 3/4-wire ECG patient cable can be display (used normally for the Demand Pacemaker) and can be used for a continuously attended patient ECG signal display (without alarm handling)
- ▲ The device is for use by professional persons who are trained in basic life support (BLS) and defibrillation or advanced cardiac life support (ACLS). The device is intended for single patient use only.
- ▲ It is the user's responsibility to ensure they are properly prepared to use the product. The user must be trained in the use of this product and must read this manual thoroughly before use. RDT can provide direct training courses if preferred.
- ▲ The device is intended to be used in following environmental:
 - Primarily in pre-hospital care and transport applications (including ambulances, fixed and rotary wing aircraft).

1.1.2 Contraindication for use



- ▲ Do not use the device in or near magnetic resonance imaging equipment (MRI) .
- ▲ **Danger of explosion!** — The device must not be used in areas where there is any danger of explosion. There might be a danger of explosion in areas where flammable products (petrol), flammable anesthetic agents or products for skin cleaning/disinfection are in use, or where the ambient air oxygen concentration is higher than 25%.
- ▲ The CPR feedback option is contraindicated for use on neonatal and pediatric patients under 8 years. CPR feedback option is contraindicated when manual CPR is contraindicated.
- ▲ Do not use the device for unattended ECG monitoring.

1.1.3 Responsibility of the User



- ▲ The numerical and graphical results and any interpretation given must be examined with respect to the overall clinical condition of the patient and the general recorded data quality.
- ▲ Do not leave the patient unattended.
- ▲ The indications given by this equipment are not a substitute for regular checking of vital functions.
- ▲ The user must read and understand the user guide, and especially these safety notes.
- ▲ Operating a device with a defective casing, defective cables and sensors constitutes a danger to the patient or the user! Therefore:
- ▲ Immediately replace a damaged unit, damaged cables and damaged connections. Immediately replace damaged or missing components.
- ▲ Only use accessories and disposables recommended or supplied by RDT. The use of third-party accessories (including disposables) may result in injury, inaccurate information (electromagnetic disturbance) and/or damage to the device.
- ▲ **WARNING** - The device including accessories must be serviced on a regular basis (see [6.1 Daily check and Maintenance interval](#)).
- ▲ The **Tempus LS-Manual** is an emergency device and must be ready for operation at any time and in all situations. Ensure that the device is always equipped with a sufficiently charged battery and keep a spare battery at hand.
- ▲ Properly dispose of the packing material and make sure it is out of children's reach.

1.1.4 Organizational Measures



- ▲ Before using the unit, ensure that an introduction regarding the unit functions and the safety precautions has been provided and understood.
- ▲ Always store the user guide at hand near the device. Make sure that the instructions are always complete and legible.
- ▲ Do not use the device and disposables if the packaging is damaged or has been unintentionally opened before use.
- ▲ Do not use the device if the packaging has been exposed to environmental conditions outside of those specified (see section [7.1 Physical characteristics and environmental specifications](#)) and contact rdt.

1.1.5 Safety-Conscious Operation



- ▲ This user guide, and especially these safety notes, must be read and observed.
- ▲ Danger of electric shock!
The energy applied to the patient can be conducted through the patient to other persons, who may suffer a lethal electric shock. Therefore:
 - Do not touch the patient, the electrodes or other conducting objects during defibrillation
 - Do not defibrillate the patient in a puddle of water or on other conductive surfaces
 - Switch the device off when it is not in use.
- ▲ To keep the patient safe, ensure that neither the electrodes, including the neutral electrode, nor the patient, or persons touching the patient, come into contact with conducting objects, even if these are earthed.
- ▲ Immediately report any changes that impair safety (including operating behavior) to the person responsible.
- ▲ Only connect original RDT accessories to the device.
- ▲ Before switching on, check if the unit's casing and electrode connection are undamaged.
- ▲ Only operate the device in accordance with the specified technical data (see [Chapter 7 Specification and standards](#)).
- ▲ Special caution must always be taken on intracardiac application of medical equipment. Especially make sure that no conducting parts connected to the unit's isolated patient input (patient, plug, electrodes, sensor) come into contact with other, earthed conductive objects, as this might short-out the patient's isolation and remove the protection of the isolated input.
- ▲ Carefully route patient cabling to reduce the possibility of patient entanglement or strangulation.
- ▲ Do not place the device where it can be controlled by the patient.
- ▲ Position the device so that there is no possibility of it falling on the patient or floor.
- ▲ To prevent cross-infection, do not reuse disposable accessories marked with the symbol .
- ▲ If unexpected readings are obtained, the operator should check the connections and verify the readings according to section [6.2 Functional test](#).
- ▲ Do not loop the patient cabling into a tight coil or wrap around the device, as this can damage the patient cabling.
- ▲ **Warning: MR-unsafe!** 
 - Do not expose the device to a magnetic resonance (MR) environment.
 - The device may present a risk of projectile injury due to the presence of ferromagnetic materials that can be attracted by the MR magnet core.
 - Thermal injury and burns may occur due to the metal components of the device that can heat during MR scanning.
 - The device may generate artifacts in the MR image.
- ▲ The device may not function properly due to the strong magnetic and radio-frequency fields generated by the MR scanner.
- ▲ Do not use the AC/DC power supply Type ASTEC Model DPS53-M above 4000 m/ 13123 ft sea level and outdoor (including ambulances, fixed and rotary wing aircraft)

1.1.6 Operation with other Devices



- ▲ The patient can be endangered by excessive leakage currents (summation of leakage currents) if:
 - several devices are connected to the patient
 - other equipment is connected to the **Tempus LS-Manual**.

→ For this reason, devices that are not required should be disconnected from the patient, and only equipment approved by RDT may be connected to the device.
- ▲ Accessory equipment connected to the analogue and digital interfaces must be certified according to the respective IEC standards (e.g. IEC/EN 60950 for data processing equipment, IEC 62368-1 for audio/video, information and communication technology equipment and IEC/EN 60601-1 for medical equipment). Furthermore all configurations shall comply with the valid version of the system standard IEC/EN 60601-1. Everyone who connects additional equipment to the signal input part or signal output part configures a medical system, and is therefore responsible that the system complies with the requirements of the valid version of the system standard IEC/EN 60601-1. If in doubt, consult the technical service department or your local representative.
- ▲ Magnetic and electrical fields of X-ray equipment, tomographs, portable communication devices, HF radios and devices labeled with the  symbol can affect the operation of this device. The **Tempus LS-Manual** has not been evaluated for compatibility with high-frequency (HF) electrosurgical equipment. Avoid using these devices or keep a sufficient distance from them. See section [6.8.1 Measures to prevent electromagnetic interference](#).
- ▲ The charging of energy and the release of the defibrillation impulse can disturb other devices. Check these devices before their further use.
- ▲ Sensors and devices that are not defibrillation proof must be disconnected from the patient before a shock is triggered.
- ▲ If the patient has a pacemaker implanted, do not position the electrode directly onto the pacemaker. Check the pacemaker after the defibrillation.
- ▲ If the ECG patient cable should become defective after defibrillation, if an electrode is displaced or an electrode resistance is too high, an audible and visual warning is issued.
- ▲ Connecting a patient to two ECG leads from two devices (e.g. **Tempus LS-Manual** and Tempus Pro), may cause electrical noise or interference that will affect the quality of ECG recordings. The ECG waveform may be distorted or unreadable.

1.1.7 Maintenance



- ▲ **Danger of electric shock!** Do not open the device. No serviceable parts inside. Refer servicing to qualified personnel only.
- ▲ Do not service or maintain the device while in use with a patient.
- ▲ **WARNING** - No modification of this equipment including sensor and accessories is allowed.
- ▲ Before cleaning, switch the unit off and remove the battery.
- ▲ Do not use high temperature sterilization processes (such as autoclaving). Do not use E-beam or gamma radiation sterilization.
- ▲ Do not use solvent or abrasive cleaners on either the unit or cable assemblies.
- ▲ Do not, under any circumstances, immerse the unit or cable assemblies in liquid.

1.1.8 Hygiene



- ▲ For cleaning and disinfection observe the instructions given in section [6.5 Cleaning](#).
- ▲ Only use cleaning agents and disinfectants recommended by RDT. Unsuitable agents can damage the device. Clean and disinfect the device in accordance with the instructions given in this manual.

1.2 Proprietary notice

Information contained in this document is copyright © 2024 by Koninklijke Philips N.V. may not be reproduced in full or in part by any means or in any form by any person without prior written permission from Remote Diagnostic Technologies Limited (RDT).

The purpose of this document is to provide the user with adequately detailed information to efficiently install, operate, maintain and order spare parts for the **Tempus LS-Manual** defibrillator. Every effort has been made to keep the information contained in this document current and accurate as of the date of publication or revision. However, no guarantee is given or implied that the document is error free or that it is accurate with regard to any specification. RDT reserves the right to change specifications without notice.

1.2.1 Implied authorization

NO IMPLIED LICENSE

Possession or purchase of this device does not convey any express or implied license to use the device with unauthorized sensors or cables which would, alone or in combination with this device, fall within the scope of one or more of the patents relating to this device.

The Bluetooth name and logo are owned by the Bluetooth SIG Inc. and any use of this name or mark is under license.

1.2.1.1 Limited warranty

Remote Diagnostic Technologies Limited ('RDT') warrants each new **Tempus LS-Manual** to be free from defects in workmanship and materials under normal conditions of use and service. For details please refer to the Terms and Conditions of Sale. Consumable items are expressly excluded from this Warranty. RDT's sole obligation under this warranty will be to repair or, at RDT's option, replace products that prove to be defective during the warranty period. The foregoing shall be the sole warranty remedy. Except as set forth herein, RDT makes no warranties, either expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose. The warranty shall be void if the **Tempus LS-Manual** is in any way modified or if it is used with non-approved consumables, unless specifically authorized in writing by RDT, and RDT shall not be liable in any event for incidental or consequential damage. This warranty is not assignable. Full terms and conditions of sale are available from RDT and are provided with your order confirmation. All specifications quoted in this manual are nominal unless detailed otherwise.

1.2.1.2 Service support and returns

Repairs made under warranty to any **Tempus LS-Manual** must be made by the manufacturer. If the **Tempus LS-Manual** requires repair or return for any reason, please contact your local distributor or Remote Diagnostic Technologies in order to first obtain a returns reference (RMA) number. RDT reserves the right not to accept returns which have not first been provided with an RMA number. When calling, please be ready to quote the serial number of the **Tempus LS-Manual**.

The **Tempus LS-Manual** is designed to be as maintenance free as possible.

In the event that the device fails to operate correctly or in a way that is not described in this manual, stop using the device immediately and switch the device off immediately. Contact the manufacturer or distributor at once. Do not attempt any kind of corrective action and do not connect the device to a patient. If the device malfunctions and may have caused or contributed to a serious injury of a patient or user, RDT must be notified immediately by telephone, fax or written correspondence.

1.3 Display symbols and indicators

1.3.1 Symbols used in this user guide

The safety level is classified according to ISO 3864-2. The following overview contains the safety symbols and pictorials used in this user guide.

**DANGER**

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING**

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**CAUTION**

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.



▲ For general safety notes as listed in this section.

**Notes**

For important and helpful information.



The device is not intended to operate in MR environment. The device is unsafe in a MR environment.

1.3.2 Symbols used on the device

Symbol	Description	Symbol	Description
	Signal input type CF: Highly isolated port, defibrillation protected. However, it is only defibrillation protected when used with the original RDT patient cable.		Only for defibrillator input. Type BF classified, defibrillation protected.
	Manufacturing date		Used for electrical dangers during defibrillation (Tempus LS-Manual)
	Manufacturer address		Note accompanying documents!
	Read the instruction for use		Caution: Prescription Only. Federal law restricts this device to sale by or on the order of a physician.
IP65	The device is protected against dust and powerful water jets against the enclosure from any direction shall have no harmful effects.		
	Symbol for the recognition of electrical and electronic equipment. The device must be disposed of in a municipally approved collection point or recycling center when it is no longer required. Improper disposal harms the environment and human health due to the presence of dangerous substances in electrical and electronic equipment.		
	Devices with Bluetooth FCC ID: T7VPAN10 Attention: Non-ionic electromagnetic environment. The device contains an HF transmitter. The Tempus LS-Manual radiates high-frequency electromagnetic energy during telemetric ECG data transfer and can disturb other devices if not installed and operated in accordance with the user guide. However, even in the case of correct installation/operation, there is no guarantee that no interference can occur. If the Tempus LS-Manual causes interference, this can be prevented by switching off or not sending data. The user can take the following measures to solve this problem: • Increase the distance between the disturbed device and the Tempus LS-Manual. A minimum distance of 20 cm must be kept between the device and a pacemaker. • Turn the device to change the antenna's angle of radiation. • Connect the device to a different mains connector. For more details, see section 7.6.1 Electromagnetic emissions.		

1.3.3 Symbols used on the battery

Common symbols

Symbol	Description	Symbol	Description
	The unit/component can be recycled.		Battery must not be disposed of with domestic refuse.
	Manufacturer symbol, manufacturing date		Prescription Only. Federal law restricts this device to sale by or on the order of a physician.
	Manufacturer address		Read the instruction for use

Safety notes on the Li-ion battery



WARNING

Risk of fire, explosion and burns.

▲ Never:

- short-circuit,
- puncture,
- deform,
- open,
- heat above 100 °C,
- immerse in water or incinerate
- charging below 0 °C



CAUTION

- ▲ Only for use with the charger supplied by RDT.

- Discharge temperature range -20 to +60 °C

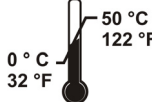
Storage temperature battery

3 to 12 months: -20 to +20 °C

1 to 3 months: -20 to +45 °C

< 1 month: -20°to +60 °C

1.3.4 Symbols used on the electrode package

Symbol	Description	Symbol	Description
	Federal law restricts this device to sale by or on the order of a physician		Read the instruction before use
	Low-density polyethylene (LDPE)		Disposable item; Single use only
	Do not use if package is damaged		Storage temperature for the electrodes
	Keep out of direct sunlight		Keep dry
	Use within 1 day after opening		

1.4 Features list

Tempus LS-Manual comes with the following items:

- Lithium-ion battery with a battery life of 300 shocks with maximum energy or >12 hour ECG display
- Defibrillation/pacing electrodes (electrodes must be ordered separately see [Section 6.9 Accessories and disposables](#) for part numbers)
-
- **Tempus LS-Manual** user manual set
- Power supply

Tempus LS-Manual has the following features:

- > 100 hours memory (FIFO) data storage for multiple patients
- Water and dust resistant to IP65
- Multiple ways of reviewing patient data, including 3 waveform color display
- A daylight readable, NVG (night vision goggles) friendly display
- Wide operating & storage temperature range
- Data sharing with **Tempus Pro** via Bluetooth or USB.

The following functionality is available with the **Tempus LS-Manual**:

Items	Provided as Standard or Optional
Manual defibrillation	Standard
synchronised defibrillation	Standard
Pacer	Standard
ECG and heart rate display	Standard
CPR Feedback with CPR Sensor	Optional

1.5 Indications for use

Background

The **Tempus LS-Manual** is a multi-function, portable device that is capable of providing defibrillation therapy, non-invasive external pacing, CPR feedback, ECG signal display in hospital and pre-hospital settings. It is to be used by qualified medical health care professionals trained in the use and operation of the device and qualified by training in advanced cardiovascular life support.

Manual Defibrillation

Use of the **Tempus LS-Manual** for defibrillation is indicated on victims of cardiac arrest where there is apparent lack of circulation as indicated by these three conditions:

- Unconsciousness
- Absence of breathing, and
- Absence of pulse.

This product should be used only by qualified medical personnel for converting ventricular fibrillation and ventricular tachycardia.

Defibrillation is indicated for adult and pediatric patients. When a victim is less than 8 years of age, or weighs less than 55 lbs. (25 kg), the **Tempus LS-Manual** should be used with the Tempus Pediatric Electrodes or in pediatric mode with the Tempus adult electrodes. Therapy should not be delayed to determine the patient's exact age or weight.

Cardioversion

The **Tempus LS-Manual** may be used for synchronised cardioversion to terminate atrial fibrillation (AF) or ventricular tachycardias (VT) by using the R-wave of the patient's ECG as a timing reference. A qualified user trained in the operation of the device must decide when synchronised cardioversion is appropriate. Cardioversion is indicated for adult and pediatric patients.

External Pacing

The **Tempus LS-Manual** is indicated for temporary external cardiac pacing in conscious or unconscious patients as an alternative to endocardial stimulation. The purposes of pacing include:

- Resuscitation from standstill or bradycardia of any aetiology
- As a standby when standstill or bradycardia might be expected
- External Pacing is indicated for adults and pediatric

ECG Display

The **Tempus LS-Manual** is intended to display a patient's ECG from a 3- or 4- lead wire ECG patient cable. It is indicated for use in adult or pediatric patients for attended monitoring of the patient's ECG signal (e.g before starting demand pacing or after successful defibrillation).

CPR Feedback

The **Tempus LS-Manual** may be supplied with an optional CPR feedback feature which is intended to provide visual and audio feedback to encourage rescuers to perform CPR in accordance with AHA/ERC guidelines for chest compression rate and depth. It is indicated for use on adult and pediatric patients ≥ 8 years of age or weighing ≥ 25 kg (55 lbs).

1.6 Additional statements

FCC statement

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to both Part 15 of the FCC (Federal Communications Commission) Rules and the radio interference regulations of the Canadian Department of Communications. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This device contains **FCC ID: T7VPAN10**

When using the Bluetooth option, operation of this equipment requires the prior coordination with a frequency coordinator designated by the FCC for the Wireless Medical Telemetry Service.

This device complies with Part 15 of the FCC rules. Operation is subject to the following conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.



CAUTION

- ▲ Any changes or modifications to this equipment not expressly approved by RDT may cause harmful radio frequency interference and void your authority to operate this equipment.

Chapter 2

Getting started

This chapter explains the basic principles of operation i.e. connections, turning on, function buttons, LCD screen information, etc.

2.1 Unpacking the Tempus LS-Manual

The **Tempus LS-Manual** is supplied from the factory in protective outer packaging. No special precautions are required when unpacking the Tempus LS-Manual. RDT recommends that you keep the packaging.

RDT recommends that the equipment is inspected and tested on receipt to confirm that the unit has not been damaged and that all expected items and accessories have been received and are in working order. New batteries should be charged up for at least four hours on receipt.



Confirm that all items ordered have been received, as detailed in [1.4 Features list](#).

2.2 Before deployment

Carefully check all the relevant settings on each **Tempus LS-Manual** before it is deployed. When deploying multiple units, you may set up a single unit and export the configuration from one unit to the others (clone the settings). To export or import configuration files go to: **System/Maintenance Settings/Default setting storage** (see [5.2.7 Default settings storage](#))

The following configuration settings are exported and imported:

Default settings include:

- Defi pacer
 - Pacer enabled
 - Default Pacer mode
 - Default Pacer rate
- Defi Manual
 - Energy adult
 - Energy pediatric
 - Auto Sync Enabled
 - Sync soft -Key
 - SYNC ON after shock
 - Start Metronome default
 - Metronome ratio default
- Metronome Settings
 - Metronome Rate
- CPR Sensor
 - Rate limit upper (cpm)
 - Rate limit lower (cpm)
 - Depth limit upper (mm/inches)
 - Depth limit lower (mm/inches)
 - User feedback delay (sec)
 - Average rate max cpr
- Monitor (ECG display)
 - Mains filter
- Printer
 - Print on SHOCK
 - Print on START pacing

- System settings
 - Ready-To-Use setting (ON/OFF, Interval for test)
 - Default settings (Start up view, Brightness, Volume, ECG Amplitude and Speed, HR/PP source, Auto switch OFF, Units.
 - Tactical mode setting
 - Communication settings
 - Language
 - Country
 - Date, Time, Timezone
 - Software Installation
 - Maintenance Passkey
 - Service settings

**Important**

Ensure that the **Tempus LS-Manual** is configured with the correct language before deployment. Language is configured in the System Settings menu, see "[5.2.6 System Settings](#)".

Initial settings

The device starts with the initial setting screen always when restoring the factory defaults in the **System > Maintenance Settings > Default settings Storage** (see [page 86](#)). The following settings appears on the initial setting screen:

- Language
- Country
- Current time display
- Current Date display
- Timezone
- Setting Date, time, Timezone >>>

To go directly into the operational mode press the “**Cancel**” button. The screen appears again after cycling the power on/off.

To confirm the displayed setting or the changed setting press the “**Confirm**” button. Message “Default settings stored” appears. The screen does not appear again after cycling power on/off.

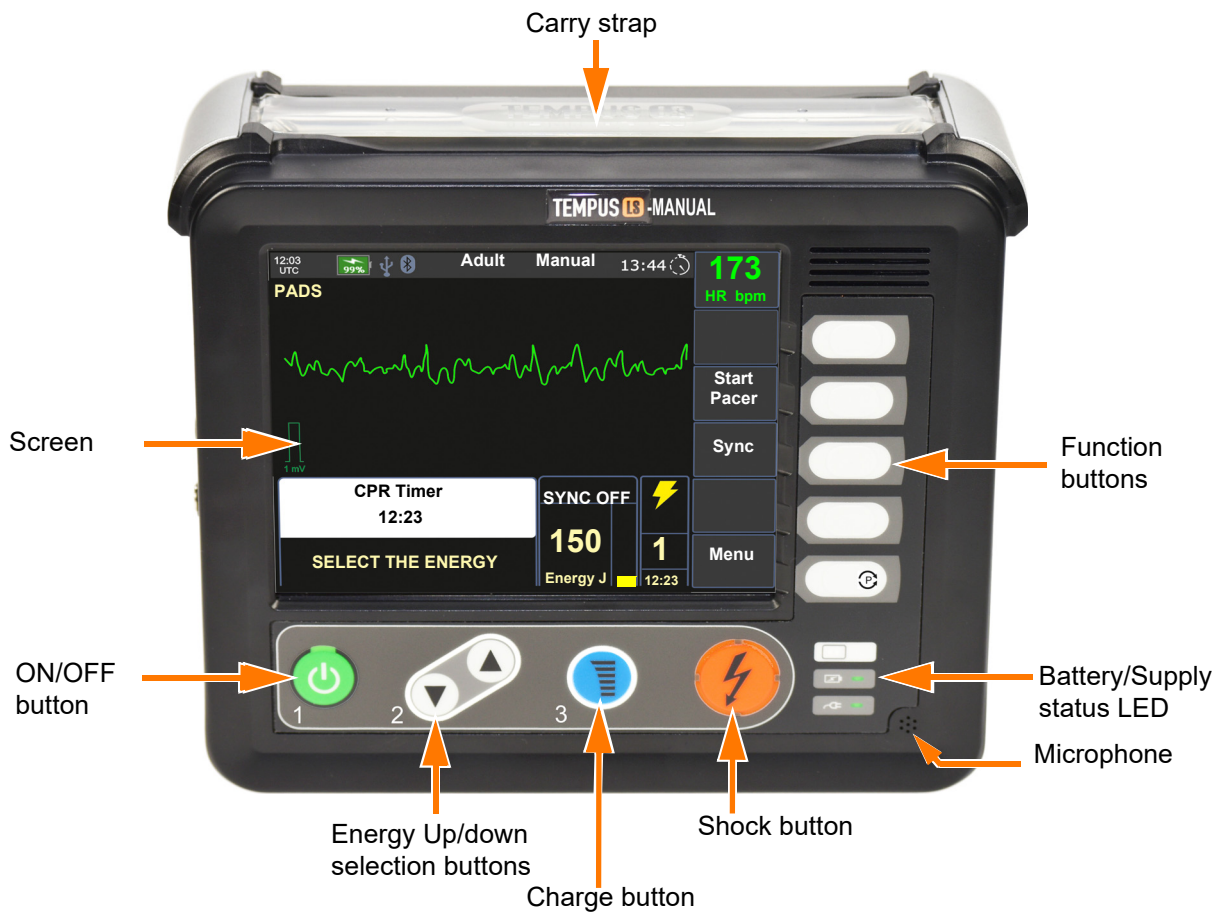
**Important**

With the confirmation of this dialog, the ready to use display (RTU) is set to ON with an interval of 1 day (see "[Ensuring operational readiness](#)" on [page 33](#)). If the Cancel button is pressed, the RTU display is set to off!

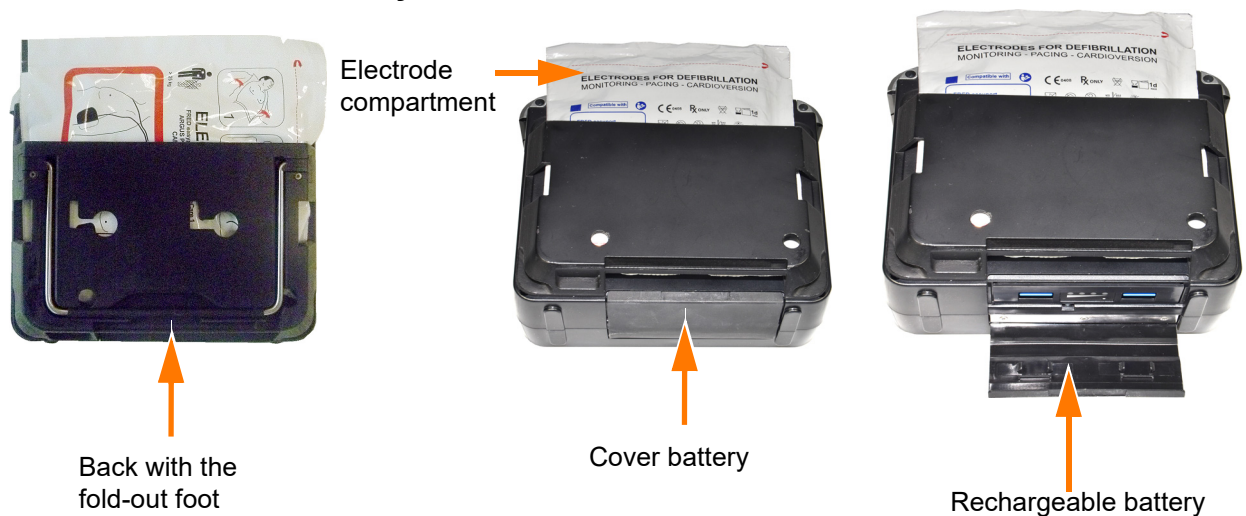
2.3 Overview of the Tempus LS-Manual

2.3.1 Key features of the unit front

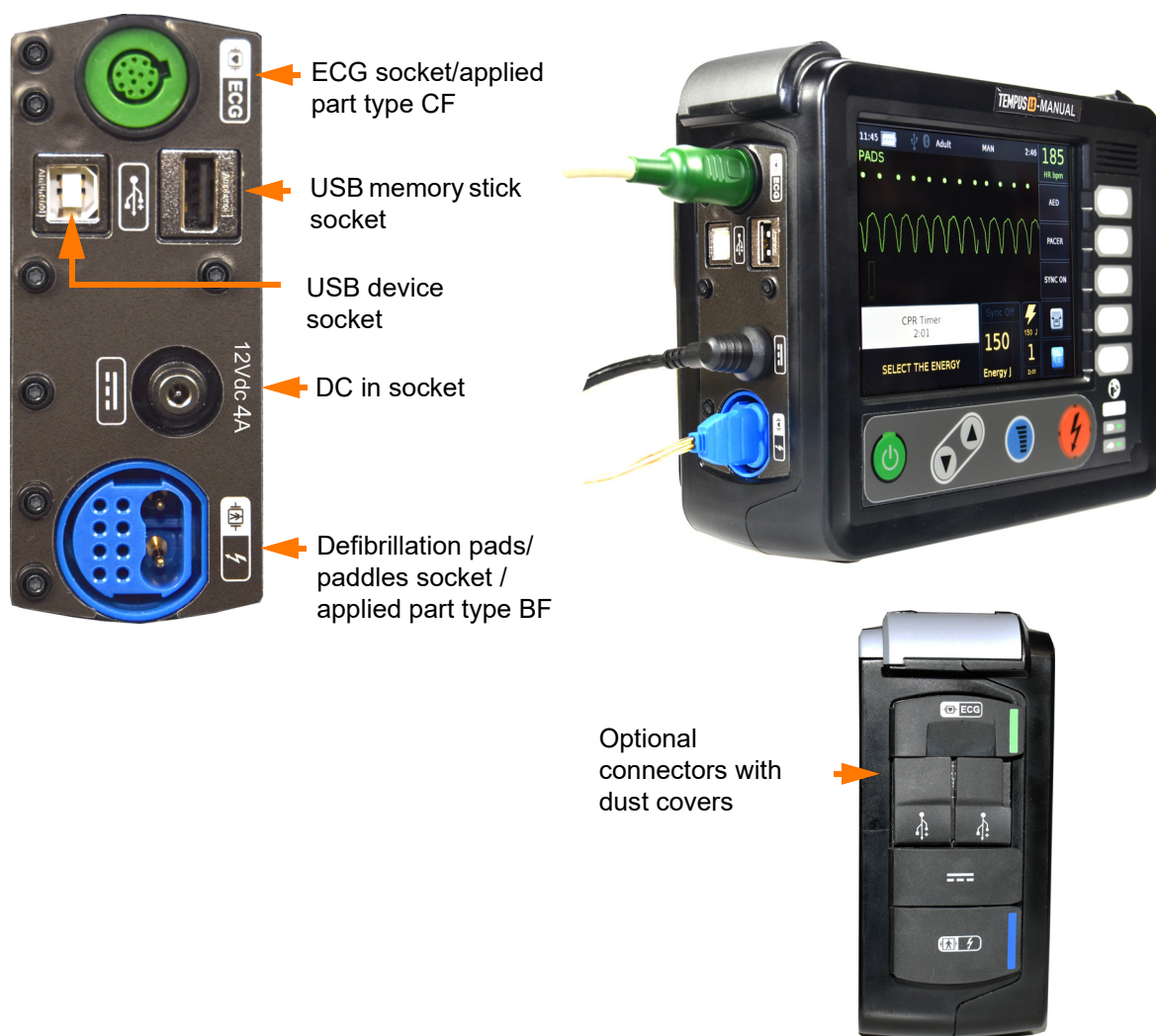
The key features of the Tempus LS-Manual are annotated in the views below.



2.3.2 Back view with battery



2.3.3 Socket panel

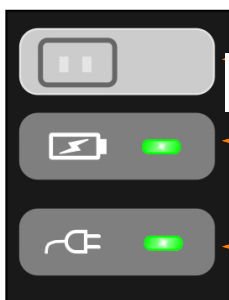


WARNING

USB connection are only for medical device approved by rdt.

2.3.4 LEDs

The LEDs give the following information:



Flashing red/green when a new battery is inserted. Stops flashing after power up. When RTU (ready to use) setting is on, refer to section ["Ensuring operational readiness" on page 33](#).

Battery charging (fast charging) when LED lights green.

Mains supply connected when LED lights green.

2.4 Switching the device on and off

2.4.1 Switching the device on

Switch the device on by pressing and holding the green On/Off button  until the green power LED illuminates.

2.4.2 Switching off and disconnecting from the external supply

1. Press and hold the **on/off** button until the **Tempus LS-Manual** beeps, the message “Shutdown in progress” appears.
2. Remove the external DC supply.



Forced shutdown procedure

If the device cannot be switched off via the above procedure, press and hold the green **on/off** button until the device switches itself off.

When connected to Tempus Pro

When the **Tempus LS-Manual** is switched off while connected to the **Tempus Pro** and while data is uploaded to the **Tempus Pro**, a dialog informs the user that the **Tempus LS-Manual** will shut down once synchronization is complete.

2.4.3 The tactical mode



WARNING

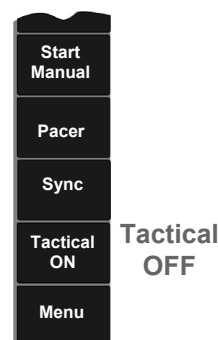
- ▲ To ensure that the **Tempus LS-Manual** is safe to use when using NVGs (night vision goggles) go to the menu **System > Tactical mode >** and select “ON” or press the button “Tactical ON” if displayed: Brightness set to Min and LED Indicators set to off, except if a high priority alarm is present. Additional audio output and wireless transmission can be switched off.
- ▲ The Tactical mode button is intended for use by military and civilian pre-hospital care users for scenarios where low emitted light and low emitted sound is required or desired. Users are reminded that while these functions are enabled, the device will not emit audible alarms from the speaker and may present a display that may be too dim to see in daylight conditions. Users should therefore ensure that they use these features only when required and recognize that greater levels of patient care and supervision will be required.

Activating tactical mode

Go to menu **System > Tactical mode >** and select “On”.

Setup tactical mode button

To display the tactical mode (ON/OFF) button on the main screen, go to menu **System > Maintenance Settings > System Settings > Tactical mode settings** (see [page 86](#)).



2.5 New patient

To finish an intervention and start a new intervention, go to menu **Patient > New Patient** and press **Start**.

This finishes an intervention, stores the intervention file, resets the intervention timer and starts a new intervention. The following user settings will be restored to default settings:

- Sync mode
- ECG Amplitude (mm/mV)
- ECG Speed (mm/s)
- Pacemaker Mode



- An intervention is also finished when the device is switched off longer than 2 minutes.
- If the device is switched off for less than 2 minutes, the last settings remain stored and the intervention continues. However, this does not apply when the device is connected to the **Tempus Pro** and data is being synchronised: in this case, the intervention is closed.

2.6 External DC supply and battery operation



DANGER

- ▲ Please read the safety notes in section [1.1 General safety notes](#) before initial operation.
- ▲ **Danger of explosion!** The device is not designed for use in areas where an explosion hazard may occur. Also, it is not permitted to operate the defibrillator in an oxygen-enriched environment or in the presence of flammable substances (gas) or anesthetics. Oxygenation in the vicinity of the defibrillation electrodes must be strictly avoided.
- ▲ **Danger of electrical shock!** The **Tempus LS-Manual** is a high-voltage therapy device. Improper use of the device can endanger life. Always follow the instructions given in this user guide.
- ▲ The user must make sure that there are no conductive connections between the patient and other persons during ECG analysis and defibrillation.
- ▲ Avoid defibrillation in very moist or wet surroundings.
- ▲ Electrical shock hazard. Do not operate the unit if the earth connection is suspect or if the power supply unit/mains lead is damaged or suspected of being damaged.
- ▲ Do not use the external power supply above 4000 m or outdoor including ambulances, fixed and rotary wing aircraft.

2.6.1 External DC supply



CAUTION

- ▲ Please note that **NO** defibrillation shocks can be delivered when the battery is depleted, missing or defective even when an external power supply is connected.
- ▲ Position the external power supply so that the mains connection is easily accessible at all times.

1. Insert the battery.
2. Connect the external power supply (1).



3. Connect the mains plug of the external power supply to the mains supply.
4. Check the LED (3) lights green when the power supply is connected to mains supply.
5. Check the LED (2) lights green (battery fast charging)
6. Press the **ON/OFF** button (4) to switch the **Tempus LS-Manual** on.
7. Check battery charging LED (2) and the battery status in the LCD according to [2.6.2 Battery operation](#).

2.6.2 Battery operation



WARNING

- ▲ Ensure that the **Tempus LS-Manual** battery charge is 100% every time you go on shift.

Charging battery



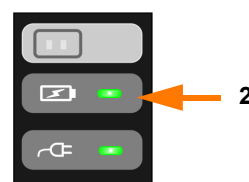
Important

The power battery is automatically recharged when the device is connected to the external DC supply via the external power supply. The power battery requires approx. 3/3.5^a hours to be recharged to 90%.

To optimize battery life, fully recharge the battery whenever possible

The recharging of the battery is indicated by the LED above the battery symbol.

- LED (2) is continuously on = battery is fast charging
- LED (2) is flashing = no battery inserted
- LED (2) is continuously off = battery is not in fast charge but may still be charging



If the device gets too hot, charging stops. As soon as the temperature has decreased to an acceptable level, the charging resumes.

a. Charging time for battery part number 01-3011/01-3030.

Battery status screen

When the device is switched on, the capacity status is displayed in the top left corner of the screen.

Tempus LS-Manual is **not** connected to mains power.



Tempus LS-Manual is connected to mains power and charging is in progress.



Tempus LS-Manual cannot communicate with the battery - check the following:



- Is the battery fitted?
- Are the battery clips fully engaged?
- Are the battery contacts clean and undamaged?
- Is the battery in deep discharge state?

Low battery indication

When the battery is nearly empty, the symbol  is displayed in the top left corner of the screen, a technical notification is displayed “**CAUTION: Battery below 10%**” and an acoustic signal sounds.

The audio signal can be silenced by the user.

Empty battery indication

When the battery is nearly empty, the symbol  is displayed and in the top left corner of the screen and a technical alarm is displayed "Battery empty: Shutdown in 2:00!" and an acoustic signal sounds:

→ Replace battery with a fully charged battery, or connect the power supply.

Changing battery



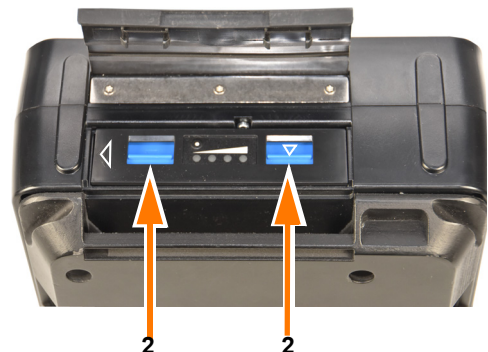
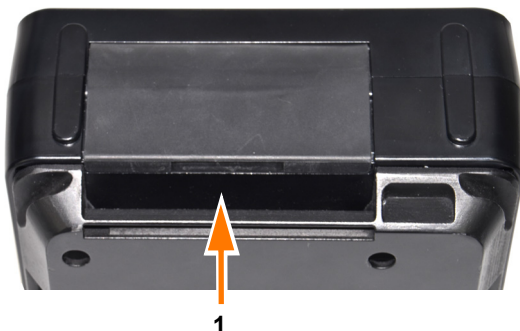
CAUTION

- ▲ Please note that **NO** defibrillation shocks can be delivered when the battery is depleted, missing or defective even when an external power supply is connected.
- ▲ Do not hot-swap the battery while charging or charged ready for shock.
- ▲ Replacement of lithium batteries by inadequately trained personnel could result in a hazard.

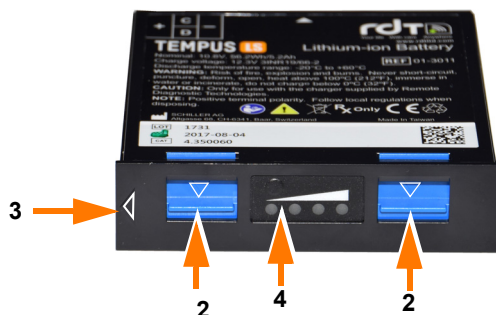


- The battery can only be inserted in one way.

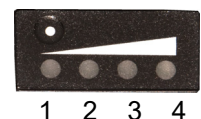
1. Open the battery cover (1).
2. Press the two blue catches (2) (direction indicated with two arrows) to release and remove the battery.



3. To replace, proceed as follows:
 - Press the battery test key (4). The LEDs indicate the current charging level of the battery.
 - Slide the battery into the battery compartment with the markings positioned as shown (3).
 - Push home until the battery clicks in place with the blue catches (2).



- LED 1 flashing = < 10 %
- LED1 = 10...25%
- LED1/LED2 = 26...50%
- LED1 /LED2/LED3 = 51...75%
- LED1 /LED2/LED3/LED4 = 76...100%



If the battery voltage is too low or the battery is inoperable, there will be no LED indication

4. Close the battery cover and make sure that the cover is clicked in properly.

5. Turn the **Tempus LS-Manual** on and check battery charging LED and the battery status in the LCD according to [2.6.2 Battery operation](#).

2.6.3 Interruption of external power supply



If the external DC supply is interrupted, the device automatically switches over to battery operation. The user settings are maintained.

2.6.4 Isolating from the mains

- To isolate the device from the mains supply, remove the mains plug from the external power supply unit.

2.7 Ensuring operational readiness



Important

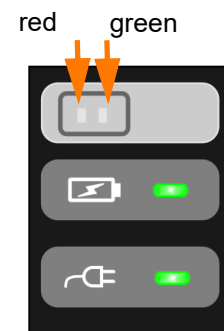
Do not expose the device to direct sunlight, or extremely high or low temperatures. The ambient temperature should be in the range 0°C to +50 °C (32 °F to +122 °F). Lower or higher ambient temperatures will have a negative impact on battery life.

2.7.1 Ready to use LED

When “Ready to use” function is activated, the **switched off device** shows the operational readiness status based on the set test intervals (see ["System Settings" on page 84](#)). The operational readiness is indicated by the LED state:

- **Green flashing** = ready for use
 - **Red flashing** = not ready for use, device failure
 - **Red/green flashing** = switch the device on to confirm the battery status
 - **LED Off** = battery depleted or device failure, not ready for use.
- If tests failed, switch the device on and read the notification in the message area and proceed according the ["General errors & troubleshooting" on page 109](#) and ["Technical alarms, notifications" on page 110](#)
- These tests can be executed also manual see ["Self tests" on page 92](#).

Device Status ready to use



The following components are tested:

- Relay (High voltage)
- IGBT (Insulated Gate Bipolar Transistors)
- Battery
- Capacitor

2.8 Display of technical alarms and notifications

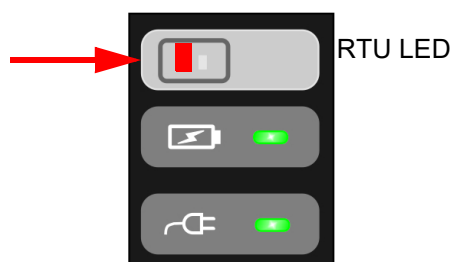
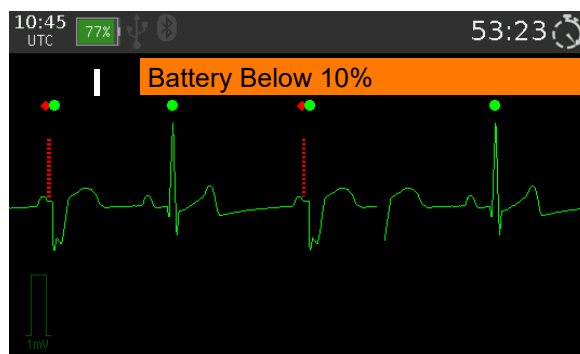


- Only technical alarms and notifications are issued, no physiological alarms.
- High priority technical alarms are issued according 60601-1-8.
- Audible alarms can be suppressed by the “Tactical mode” see [2.4.3 The tactical mode](#).
- Notification and information are issued according the description below.

The technical alarms and notifications are displayed as follows:

- **High Priority technical alarms**
 - Text with red background
 - two beeps every 15 seconds
 - Red RTU LED blinks every 0.5s
- **Notification (caution)**
 - Text with orange background
 - one beep every 30 seconds
- **Information**
 - Text with blue background
 - one beep every 60 seconds

All alarms and notifications disappears automatically when the cause has been remedied.



Operator position



CAUTION

- ▲ Ensure that the environmental noise is below the set alarm sound volume (Volume Low/Mid/High 50/60/70dB).
- ▲ Do not set Volume below the environmental noise.
- ▲ Standard or user-defined alarm volume may vary for different environmental. Therefore, always check the set volume for the corresponding environmental.
- ▲ 2 minutes after switching off the device or main battery power interruption, the user-defined alarm volume alarm is set to default (standard setting = Low)
- ▲ If “Tactical mode” is programmed refer to section [2.4.3 The tactical mode](#) and read the safety notes.

The visual alarm display (red background) and blinking red RTU LED is visible to a distance of 4 meters.

2.8.1 Technical high priority alarms



The following technical alarms alert the user to the need to correct the technical problem in order to ensure the operation of the unit. More alarms see [6.7.2 Technical alarms, notifications](#).

Alarm message	Description/Remedy
Battery not inserted. Shutdown in m:ss	Displayed during battery replacing
Battery empty. Shutdown in m:ss	- Battery empty and automatic shutdown in progress → Replace the battery
Battery cannot be used. Shutdown in m:ss	Discharge Temperature outside the allowed limits below -20°C or above 60°C
Shock and pacing disabled due to low battery	- Low battery → Replace the battery
Device not used. Shutdown in mm:ss	- Auto switch off activated (see Default System Settings>>> 15 or 30 min) → Press any button
Key stuck detected	- Pressed or short circuit soft button detected → Restart device again and make sure that no button on the device is pressed during startup.

2.8.2 Technical notification



The following technical notification provide the user with information on correct operation of the device. More technical notification see [6.7.2 Technical alarms, notifications](#)

Notification message	Description/Remedy
Defibrillator	
Check Defibrillator Electrodes	No pads are connected → Connect/apply defibrillator electrodes
SHOCK CANCELLED	If the capacitor is charging, no DC power and no energy is available from battery → Replace the battery
Pacer	
Connect ECG cable	Not connected ECG cable → Connect ECG cable
Check ECG Electrodes	ECG cable connected but Lead(s) off → Check electrodes applied to the patient
Check Defibrillator Electrodes	Check defibrillator electrodes
Pacing Stopped	- Device stops the pacing automatically when: → ECG cable is disconnected → ECG cable is off, check ECG Leads → Defibrillator electrodes are off, check Defibrillator electrodes → When battery is empty or removed, check battery → Hardware failure
ECG	
ECG Leads Off	ECG cable connected but Lead(s) off. → Check electrodes applied to the patient
ECG cable Off	Disconnecting ECG cable from the device while it was connected to the patient → Reconnect ECG cable
Battery	
Battery Below 10%	Device is not plugged (no DC-IN) and the actual charge is below 10% but still able to deliver shocks → Replace/recharge the battery

Notification message	Description/Remedy
Battery Cannot Be Charged (High/Low Temperature)	Battery stopped charging because of too high/Low temperature. → Replace the battery with one within the temperature limits
Battery Charge Stopped	Device is plugged (DC-IN) but the main battery is not charging → Check battery/replace battery
Defective / Unknown Battery	No communication with battery → Check battery/replace battery
Memory	
FAILED To – Restore Default Settings – Export User Defaults – Import User Defaults – Export interventions – Export Log Files	If any issue is encountered while loading/storing the default settings from/to the device or USB memory stick → Check USB memory stick
Device	
Battery Test failed	Battery test failed during RTU or manual selftest Check battery/replace battery

2.9 Internal safety discharge

The **Tempus LS-Manual** has an internal safety discharge circuit for internal discharge of the defibrillator's stored energy. The energy is internally discharged when:

- the shock is not delivered within 20 seconds after charging
- function key "Disarm" is pressed (only in manual defibrillation)
- the battery voltage is insufficient
- the device is defective
- the device is turned off

Furthermore, the residual energy stored in the defibrillator 100 ms after shock release is always discharged internally.

Chapter 3

Operation

This chapter explains the basic principles of operation during defibrillation in manual and Pacemaker modes.

3.1 Manual defibrillation

3.1.1 Application guidelines and safety notes

Observe the following guidelines to ensure successful and safe defibrillation. Otherwise the lives of the patient, the user and bystanders are in danger.



DANGER

- ▲ The patient must:
 - **not** come into contact with the operator or other persons during defibrillation.
 - **not** come into contact with metal parts, e.g. bed or be positioned on wet ground (rain, accident in swimming pool), to prevent unwanted pathways for the defibrillation current, which may endanger the operator or assistants.
- ▲ Do not allow the defibrillation electrodes to come into contact with other electrodes or metal parts which are in contact with the patient.
- ▲ The patient's chest must be dry, as moisture causes unwanted pathways for the defibrillation current. For safety, wipe off flammable skin cleansing agents.
- ▲ Owing to the high currents, there is a risk of skin burns at the site of the electrodes. This is why the electrodes must not be placed on or above the sternum, clavicle or mamillas.
- ▲ Immediately prior to the shock, the heart massage (CPR) and artificial respiration must be stopped and bystanders must be warned.
- ▲ Defibrillating a patient with an implanted pacemaker is likely to impair the pacemaker function or cause damage to the pacemaker. For this reason, do not apply the defibrillation electrodes in the vicinity of the pacemaker, have an external pacemaker at hand, and check the implanted pacemaker for proper functioning as soon as possible after the shock.
- ▲ The manual defibrillator mode must never be used by non-medical or not trained/authorized medical staff.



- ▲ **Equipment damage!** Sensors and devices that are not defibrillation proof must be disconnected from the patient before a shock is triggered.

3.1.2 Defibrillating children/neonates



WARNING

- ▲ Please note that less energy is needed for children:
For the **first** defibrillation of infants and small children using biphasic shock, approx. 1 joule/kg body weight is released. An increase of 2 joules/kg body weight is possible when the defibrillation is repeated.
- ▲ For the defibrillation of children weighing less than 25 kg , the pediatric pads should be used.



CAUTION

Defibrillation on neonates

- ▲ When using the defibrillator on neonates, follow the local guidelines.
- ▲ Follow the energy setting for infants and small children as described above.
- ▲ The automatic energy setting for neonates is the same as for children.



- Menu **Patient > Patient Type Adult or Pediatric:**
 - When pediatric pads are used, the patient **Patient Type** setting **Adult** or **Pediatric** **does not** overrule the energy setting. When pediatric pads are connected to the device, the energy setting is always pediatric.
 - If no pediatric electrodes are available, adult electrodes can be used. When adult pads are used, the patient type setting “**Pediatric**” **does** overrule the default energy setting Adult to pediatric (default 50 Joules) The maximum selectable energy is 100 Joules.



3.1.3 General function

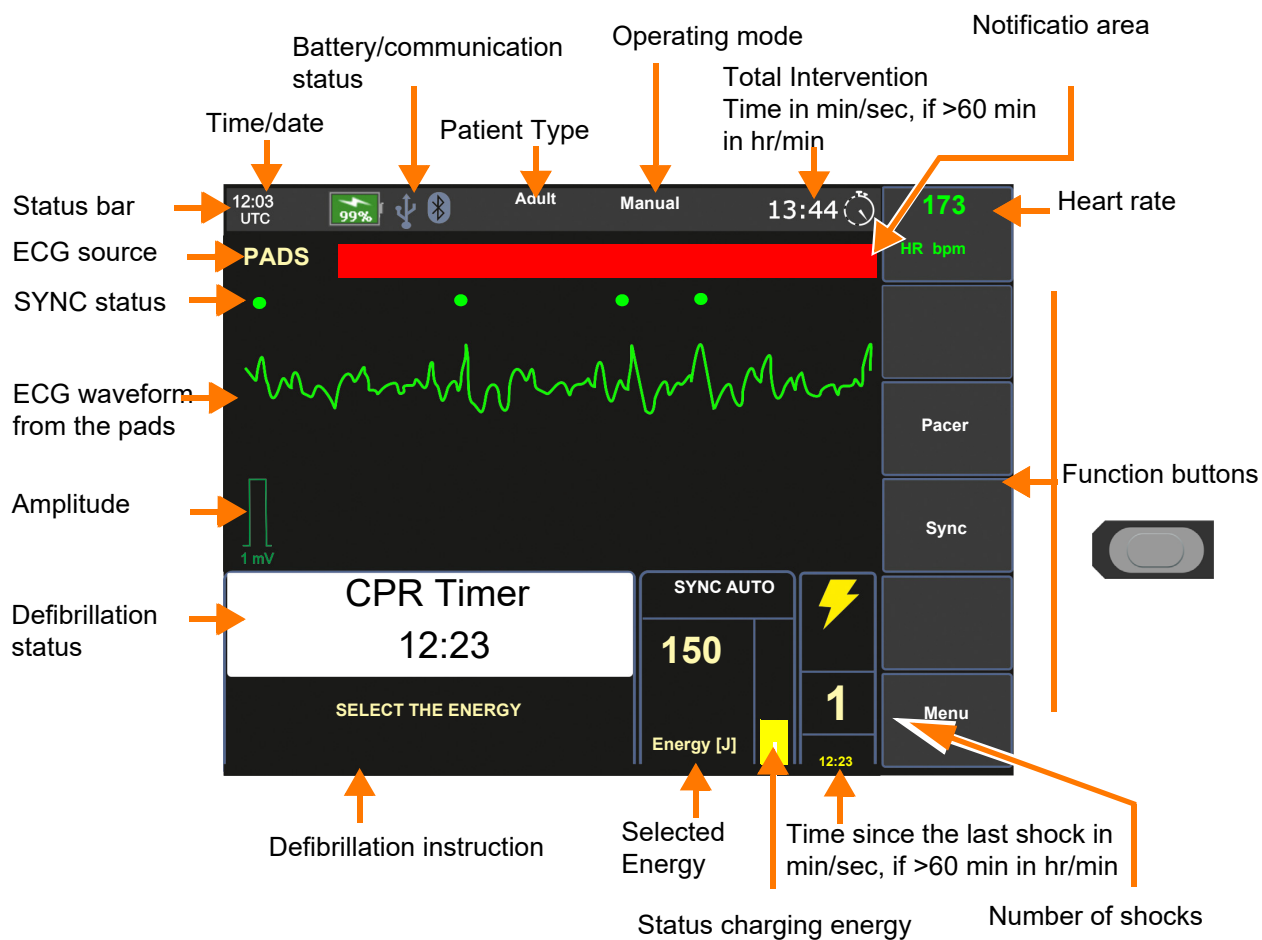


- The **Tempus LS-Manual** works with biphasic truncated exponential chopped defibrillation waveform impulses. Depending on the factory settings, the device either switches automatically from synchronised to non-synchronised defibrillation or the mode has to be changed manually using the **Sync** button.
- The required energy for a successful defibrillation depends on several parameters (body constitution, etc.). For emergency medical treatment, AHA/ERC recommend a biphasic impulse. Depending on configuration settings, the energy of the 3 first shocks can be increasing.

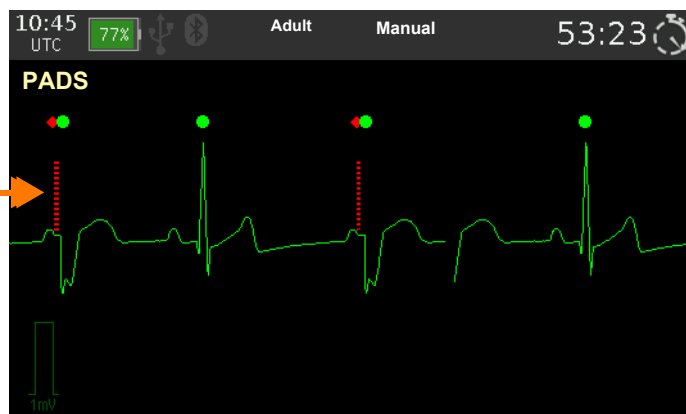
Default energy settings in manual mode

Adults	pediatric
150 joules	50 joules

3.1.4 Home screen Manual defibrillation mode

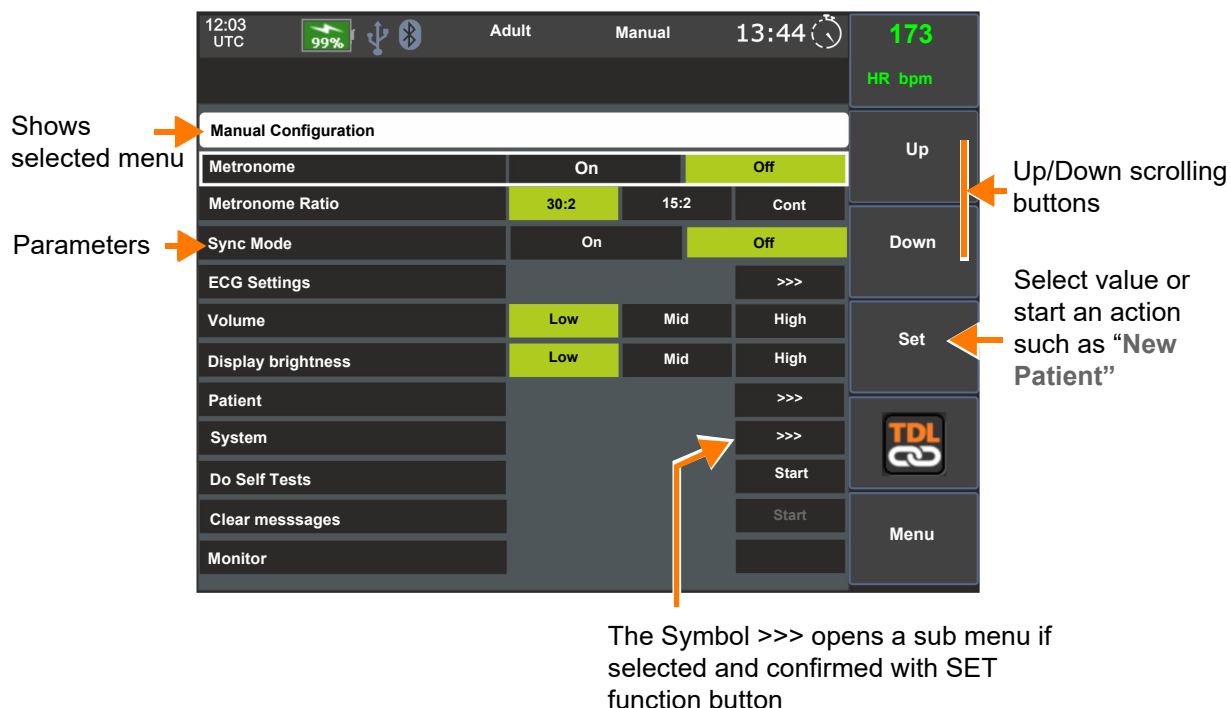


Detected pacemaker pulses (internal or external) are displayed as red, vertical dotted line



Menu

The menu screen below shows the parameters available for **Manual defibrillation** mode.

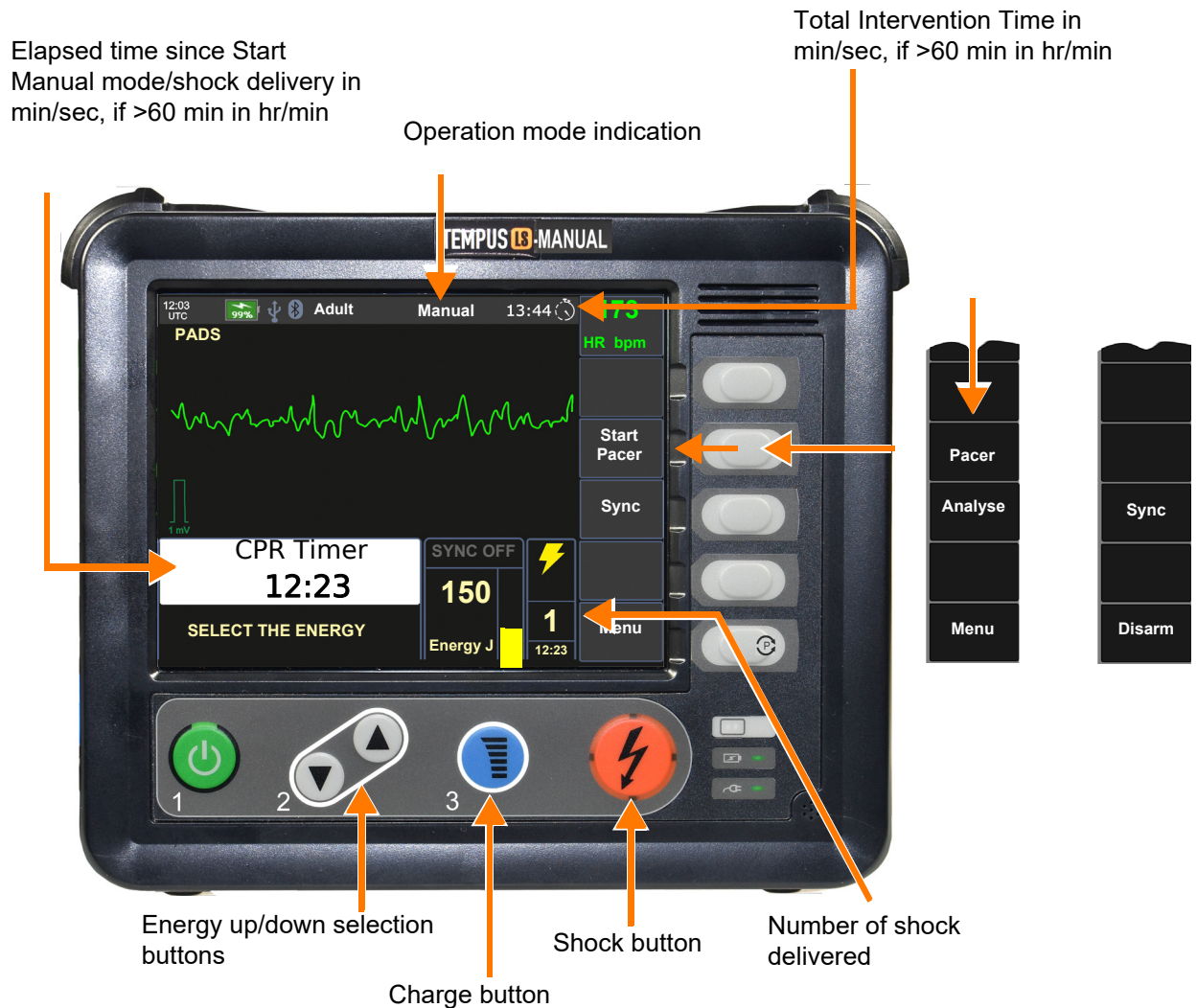


Menu Structure

Mode	Parameter	Sub-Menu >>>/Function
Manual	Metronome Metronome Ratio Sync mode Volume Display brightness	ECG Settings >>> Patient >>> System >>> Do self test Clear messages Monitor

3.1.5 Initial operation **MANUAL (Defibrillation) Mode**

- The Energy selection and Charge buttons (see below) are activated (illuminated by white LED ring)
- Function button for synchronised defibrillation (SYNC ON/OFF) is available or selectable in the menu.
- Function button to select the PACER mode



3.1.6 Manual defibrillation using pads



DANGER

- ▲ Delivering a shock to a patient with normal heart rhythm may induce ventricular fibrillation. For this reason, first read the general rules and safety information in sections [3.1.1 Application guidelines and safety notes](#) and [3.1.2 Defibrillating children/neonates](#).
- ▲ Electric shock hazard. Turn off the device before exchanging the defibrillation electrodes; exchanging the electrodes on a charged defibrillator initiates an internal safety discharge.

3.1.6.1 Applying the adult and pediatric electrodes

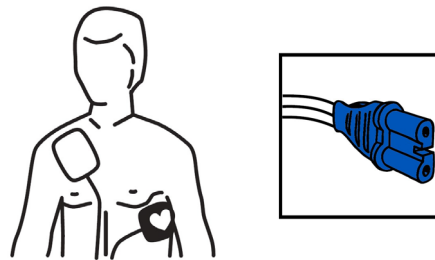


CAUTION



- ▲ Only use the pads up to their expiration date. Please note that the indicated expiration date only applies if the vacuum pack is intact.
- ▲ The pads are pre-gelled, so there is no need to use extra contact agent.
- ▲ Do **not** reuse the pads.

Adult electrodes



The adult electrodes with the blue connector are used for adults and children from 25 kg and above.

Pediatric electrodes



The pediatric electrodes with the yellow connector are used for children weighing less than 25 kg . When pediatric pads are connected the energy reverts to the default pediatric energy, which may be less than 50 joules.

3.1.6.2 Applying the electrodes



WARNING

- ▲ Good contact between the skin and the adhesive electrodes must be ensured. Suntan oil, sand or salt reduce the adhesive quality.
- ▲ The applied pads must have good contact with the patient's skin, and air bubbles under the pads must be avoided. To do so, stick on one end of the pad then smooth it out to the other end.
- ▲ The minimum safe distance between the two electrodes should be approx. 3 cm.

Adults and children more than 25 kg

Electrode placement is the same for adults and children weighing 25 kg or more, see [Fig.3.1 Adult electrode application site](#) and [Fig.3.2 Application sites for children more than 25 kg](#).

1. Clean and dry the application points for the electrodes. Only clean the skin by vigorously rubbing it with a dry cloth.
2. Apply one electrode above the right nipple. Do not apply it on the clavicle (uneven).

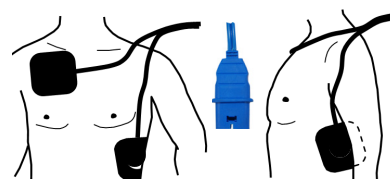


Fig.3.1 Adult electrode application site

3. Apply the other electrode slantwise below the left breast as illustrated in [Fig.3.1 Adult electrode application site/ Fig.3.2 Application sites for children more than 25 kg](#).
4. Make sure that the connections are positioned on the outside so that the cables do not hinder cardiopulmonary resuscitation (CPR).



Fig.3.2 Application sites for children more than 25 kg

Children weighing less than 25 kg

The energy setting is automatically reduced with the pediatric electrodes.

1. Clean and dry the application points for the electrodes, see [Fig.3.3 Application sites for children less than 25 kg](#). Only clean the skin by vigorously rubbing it with a dry cloth.
2. Apply one electrode on the left of the right nipple as illustrated in [Fig.3.3 Application sites for children less than 25 kg](#)
3. Apply the second electrode on the back on the same level as the chest electrode as illustrated in [Fig.3.3 Application sites for children less than 25 kg](#).
4. Make sure that the connections are positioned on the outside so that the cables do not hinder cardiopulmonary resuscitation (CPR).

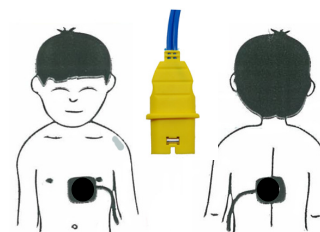


Fig.3.3 Application sites for children less than 25 kg

3.1.6.3 Manual Defibrillation Using Pads - Procedure

1. Switch on the device by pressing the green button
2. Activate Manual defibrillation with the Exit Pacer or Exit Monitor function button if not already in Manual mode.
3. Check the state of the patient.
4. Connect the electrode cable to the pads connector and apply the electrodes.

The message **Check Defibrillator Electrodes** is switched off as soon as the device measures an acceptable electrode resistance. If it is not switched off, see section [3.1.6.1 Applying the adult and pediatric electrodes](#)



Connecting Defibrillation Pads

5. Select the required energy with the  button.
6. Initiate energy charging by pressing **"Charge"**  button.



As soon the charged button is pressed, the "Disarm" function key is displayed. You can activate a safety discharge of the energy at any time by pressing the function key "Disarm".

An automatic disarm takes place after approx. 20 seconds. This is indicated by a change in the pitch of the tone 5 seconds before disarming.



DANGER

▲ Danger of electric shock!

- Do not, under any circumstances, touch the patient during shock delivery.
- Make sure that the patient does not touch any conducting objects.

7. As soon the shock button lights up, release the shock by pressing  button on the device.
8. Finish the therapy (see [3.2.5 Finishing the therapy](#)).

3.2 Synchronised defibrillation



To turn sync mode on/off use the sync mode button in the main menu (from manual mode); or use the on screen touch button (if enabled). When sync mode is on, shocks will be delivered when synchronised with a QRS.

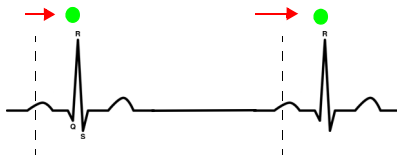
3.2.1 Warning erroneous triggering



WARNING

Erroneous triggering, interpretation hazard:

- ▲ Signal noise may disturb the ECG signal and cause artefacts. This must be considered chiefly in the synchronised mode. For this reason, the following should be observed:
 - Do not touch the device during defibrillation to prevent electrostatic noise
 - Keep the patient cable away from power cords, transformers etc.
- ▲ To achieve adequate ECG signal quality for reliable triggering, ensure that
 - the ECG signal is free of artefact
 - there are no major fluctuations in amplitude
 - the displayed trigger pulses are positioned exactly above the R-wave



3.2.2 Setup switching from unsynchronised to synchronised mode



WARNING

- ▲ The current setting must be communicated to the user.



- You can find the settings below in the menu System/Maintenance Settings/Manual Settings (see [section 5.2.1 Manual Settings, page 81](#))
- Default values are bold.

Parameter	Value	Description
Auto Sync Enabled	Yes/No	If set to "Yes" synchronised mode will be activated as soon a QRS trigger is detected. (If set to "Yes" the Status is SYNC AUTO, if set "No" the status is set to SYNC ON)
Sync soft-key	Yes/No	If set to "Yes" the user can switch between synchronised/ direct defibrillation If "No" is selected the Sync mode can be activated only via the manual configuration menu.
SYNC ON after shock	Yes/No	If set to "No" the SYNC mode is set to Off (direct defibrillation) after a shock has been released in synchronised mode. Note, this function is only true if Auto Sync Enable is set to "No".

Auto Sync Enable

Auto Sync Enable = **No**

- Activating the synchronised defibrillation by pressing the **SYNC ON (1)** function button.

If "Auto Sync Enabled" = Yes

- the Synchronised defibrillation is activated as soon a QRS is detected.

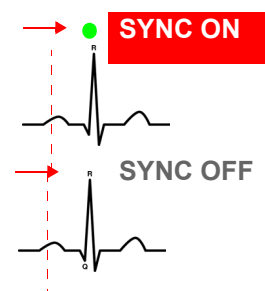
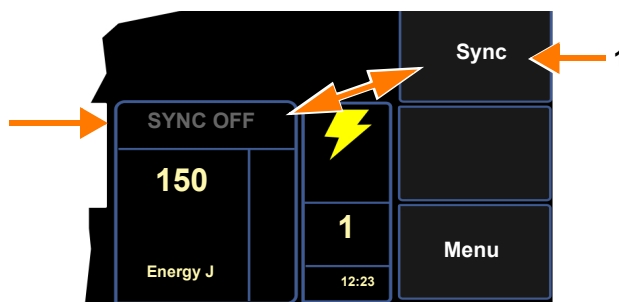


WARNING

- ▲ The device switches to **SYNC OFF** if for 2 second no QRS is detected.

SYNC modes:

- SYNC OFF
- SYNC ON**
- SYNC AUTO



Sync On after shock

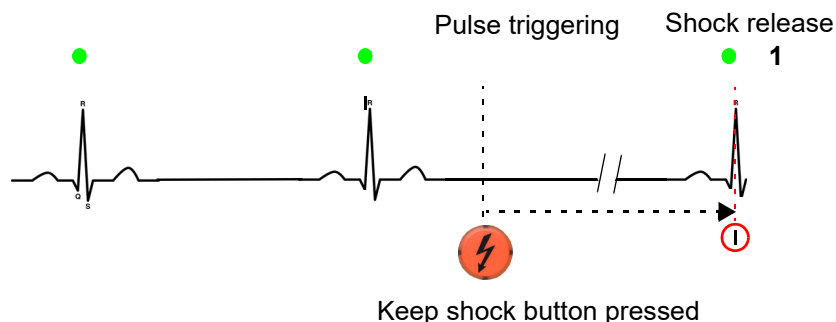
Depending on the setup, the synchronised mode stays activated after delivering the shock (SYNC ON after shock = Yes) or switches back to unsynchronised shock (SYNC ON after shock = No). The current setting must be communicated to the user.

- ▲ The default setting is “SYNC ON after shock” = **No**:
the manual activated **SYNC ON** mode as well the **SYNC AUTO** mode will be deactivated after delivering the shock. To deliver a second synchronised shock, it is important to activate it again.
- ▲ If the admin setting is “SYNC ON after shock” = **YES**:
the manual activated **SYNC ON** and as well the **SYNC AUTO** mode is maintained after delivering the shock. To deliver a unsynchronised shock, it is important to deactivate it again.

3.2.3 Function of the synchronised defibrillation procedure

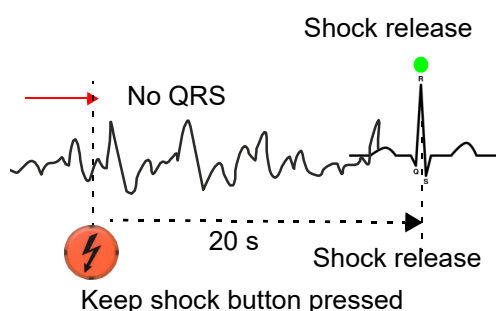


For synchronised defibrillation, the defibrillation shock is delivered in synchronisation with the heart action, as the heart is still working. After the physician has triggered the defibrillation shock, the trigger signal for the actual shock delivery will be derived from the subsequent QRS complex within < 60 ms after the trigger mark on the monitor screen (1).



CAUTION

- ▲ Be aware: If **Auto Sync enabled is Yes**, after pressing the shock button and in the absence of a QRS, after 2 seconds the device switches automatically to unsynchronised shock and the shock will be delivered to the patient.



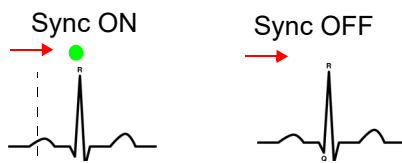
- ▲ Be aware: If **SYNC ON is activated**, that after initiation of the shock, the actual shock will be delivered to the patient with the next trigger signal (QRS) derived from the ECG. This may lead in a shock delivery delay time of 20 seconds.

3.2.4 Synchronised defibrillation procedure



If an unsynchronised shock is required while in synchronised mode, it is possible at any time to switch **(1)** the synchronised mode to **SYNC OFF** and deliver the shock immediately (unsynchronised).

1. Connect the electrode cable to the pads connector.
2. Select synchronised defibrillation (**SYNC ON** or **SYNC AUTO**) with the function button **(1)**.
3. The setting **SYNC ON/AUTO (2)** is displayed above the energy setting.

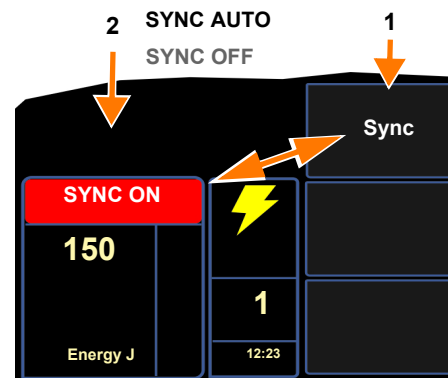


4. Check ECG rhythm:
 - the trigger pulses above the R-wave

5. Select the required energy with the  button.
6. Initiate energy charging by pressing "**Charge**"  button

→ You have now 20 seconds to work through the steps 8 and 9, before the internal safety discharge is activated because of exceeding the time limit.

7. Check ECG rhythm (trigger pulses), **SYNC ON or AUTO (2)** and energy setting.



CAUTION

- ▲ Be aware: If Auto Sync is enabled (**SYNC AUTO**), after pressing the shock button and in the absence of a QRS, after 2 seconds the device switches automatically to **SYNC OFF** and the shock will be delivered immediately.



8. Deliver the shock by pressing the button  and keep the button pressed until the shock is delivered at the next confirmed QRS.



DANGER

▲ Danger, electric shock!

- Do not, under any circumstances, touch the patient during shock delivery.
- Make sure that the patient does not touch any conducting objects.

9. After the shock is delivered, monitor the patient and the ECG signal.



CAUTION

- ▲ If the default setting is "Sync after sync shock = **No**" the synchronised defibrillation mode is switched back to **SYNC OFF** after delivering the shock.

10. If a second attempt is contemplated, return to step 4.

3.2.5 Finishing the therapy

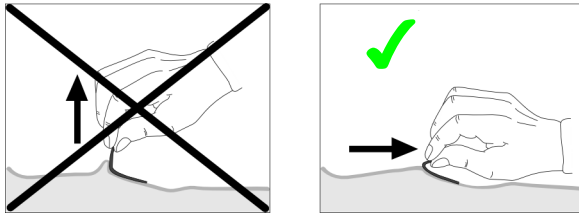
1. Switch the device off as soon as the therapy is finished by pressing and holding for two seconds the



2. Disconnect the electrode cable.

Adhesive electrodes

1. Carefully remove the electrodes from the patient's skin.



2. Discard the disposable pads immediately after use to prevent their reuse (hospital waste).
3. Clean the device and ECG cables as described in section [6.5 Cleaning](#).

3.3 Pacemaker Function



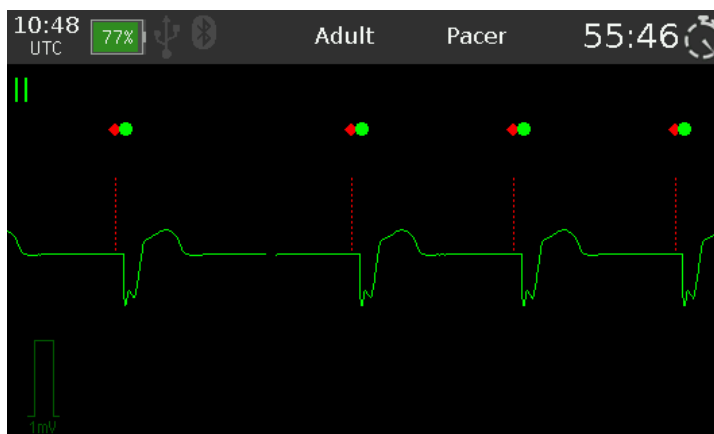
- The pacemaker is the module for external transcutaneous stimulation of the heart.
- The pacemaker offers two modes of operation, demand and fixed-rate pacing. In demand and fix mode, the pacemaker requires an ECG signal for synchronisation.
- The same, large adhesive electrodes used for defibrillation are also employed for pacing. They ensure good electrical contact with the skin. These electrodes and a 20 ms square-wave pulse reduce painful muscle contractions provoked by excessive current density.
- Prolonged pacing may cause skin irritation or burns (see information [3.3.3.1 Attaching the pacer pads](#))
- Pacer rate, pulse width and current are checked when the device is turned on and during operation; therefore, a functional test of the pacemaker module is not necessary.
- Filter setting during Pacer view:
 - HP filter: 0.3 Hz
 - LP filter: 40 Hz
- Detected pacemaker pulses (internal or external) are displayed as red, vertical dotted line. (see screen [3.3.1.1 Fixed-rate mode \(Fix\)](#) and [3.3.1.2 Demand mode](#))

3.3.1 Modes

3.3.1.1 Fixed-rate mode (Fix)



In this operating mode, the module delivers pacing impulses with the user-defined current at a user-defined rate. The selected rate remains constant and is not affected by intrinsic actions of the patient's heart. This mode is mainly used in the case of asystole. With the ECG signal from the ECG patient cable the result of the pacing can be monitored. Following an example of a paced ECG signal in fix mode:

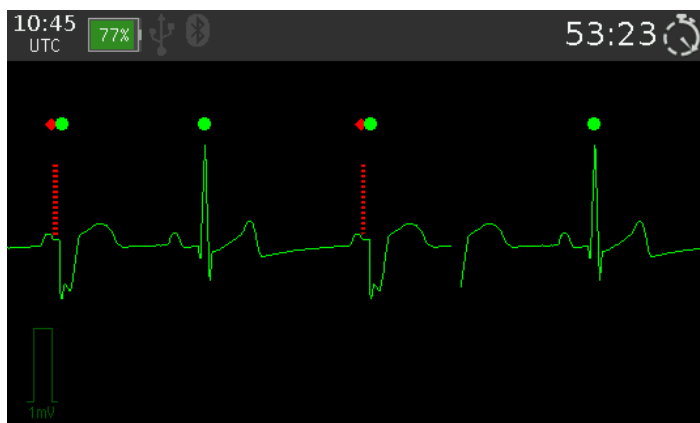


3.3.1.2 Demand mode



In demand mode, the pacemaker does not deliver pacing pulses as long as the patient's intrinsic heart rate exceeds the set pacing rate. When the heart rate drops below the pacing rate, the pacemaker starts emitting stimulation pulses. This can only be ensured by continued monitoring of the ECG with an ECG patient cable. The pacemaker reads the necessary ECG signal via the pads. If the module is not able to reliably identify QRS complexes, it will stimulate the heart permanently in demand mode.

The demand mode is the recommended pacing mode when the patient is at risk of developing bradycardia or even asystole as a result of a critical event. As the pacemaker function is controlled by the patient's ECG, the harmful competition between intrinsic and external stimulation, which could induce ventricular fibrillation, is excluded. Following an example of a paced ECG signal in demand mode:



3.3.2 Safety notes



WARNING

▲ Shock hazard

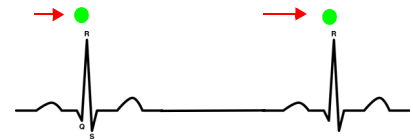
Never touch the pads or the patient's body near the pads while the pacemaker is in use.

▲ Disturbed ECG trigger signal! Signal noise may disturb the ECG signal and cause artefacts. This must be considered chiefly in the demand pacing. For this reason, the following should be observed:

- Do not touch the device during pacing to prevent electrostatic noise
- Keep the patient cable away from power cords, transformers etc.
- While the **Tempus LS** ECG leads are applied to a patient, do not apply a second set of ECG leads to the patient (e.g., from **Tempus Pro**). Connecting a second set of ECG leads simultaneously may cause the ECG signals to be distorted or unreadable. This may also cause the pacing function to not work as intended.

▲ To achieve adequate ECG signal quality for reliable triggering, ensure that

- the ECG signal is free of artefact
- there are no major fluctuations in amplitude
- the displayed trigger pulses are positioned above the QRS.



CAUTION

▲ Patient hazard, equipment failure

Equipment delivering electrical energy to the patient at the same time as the pacemaker can disturb the pacemaker function. Particularly HF surgery equipment used on a pacemaker patient may cause interference, preventing the detection of QRS complexes. In this situation, the pacemaker must be set to fixed-rate pacing (FIX). Also please note that leakage currents could be transferred to other electric circuits, interfering with the functioning of devices connected to these circuits.

- ▲ For safety reasons, the external pacemaker should be disconnected from the patient in this situation and an internal pacemaker should be used.
- ▲ Accessories, wearing parts and disposables that affect the safe use of the pacemaker and that are to be used in conjunction with the pacemaker must be tested for safety and approved by an authorized test laboratory.

3.3.3 Guidelines for the Application of External Pacemakers

These guidelines apply to all pacemakers, irrespective of type and manufacturer.

All electrical devices that deliver energy to patients in any form or have an electrically conductive connection to the patient are a potential source of danger.

As the user is responsible for the safe application of the devices, observance of the instructions given in the user manual and of the guidelines below is of utmost importance.



CAUTION

- ▲ Pacemakers must only be used under the supervision of trained, qualified and authorized staff.
- ▲ Observe the user guide for the pacemaker's operation.
- ▲ The patient must not be left unattended during pacing.
- ▲ It is assumed that the patient's ECG is being monitored to be able to assess the effect of pacing.
- ▲ When positioning the patient, take care that no electrically conductive connections exist between the patient and earthed metal parts (puddles of water, for instance, are capable of conducting the electrical current). Although the pacer current output is required to be floating, this is an additional safety precaution to ensure that the pacemaker current pulse flows only between the pacemaker electrodes.
- ▲ Set all values for the pacemaker to position 0, or the lowest value.
- ▲ Position stationary pacemakers close to the patient.
- ▲ After each defibrillation, check that the pacemaker is functioning properly.

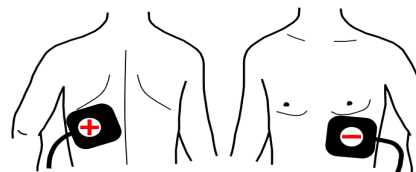
3.3.3.1 Attaching the pacer pads



- The same adhesive electrodes used for defibrillation are also employed for pacing.
- The electrodes are designed for:
 - 1 hour of pacing using 140 mA / 120 bpm, (pulse duration 20 ms)
 - 8 hours of pacing using 70 mA / 60 /bpm, (pulse duration 20 ms) with inspection of pads every 30 minutes
 - A detailed application of electrodes is given in section [3.1.6.1 Applying the adult and pediatric electrodes](#).

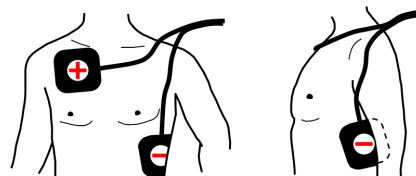
Anterior-posterior placement

1. Apply the dorsal electrode (+) to the left scapular area and the precordial electrode (-) near the left lower sternal edge.
2. Connect the pads to the device.
3. If the dorsal electrode cannot be used, apply anterior-anterior placement.



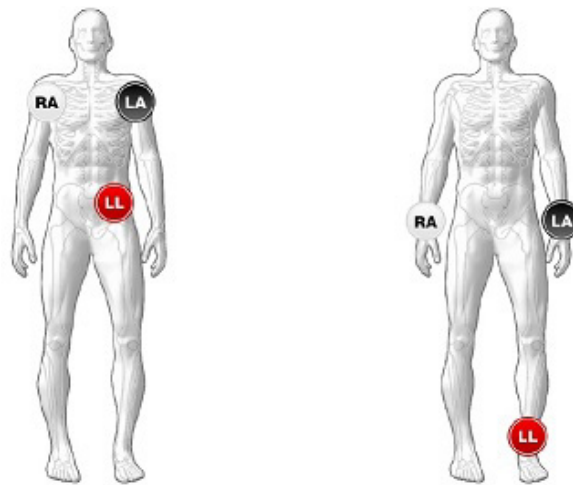
Anterior-anterior placement

1. Apply the "+" electrode on the right side below the clavicle and the "-" electrode to the left of the axillary line on a level with the 5th intercostal space so they do not hinder heart massage.
2. Connect the pads to the device.



3.3.4 3 lead ECG setup for Pacemaker

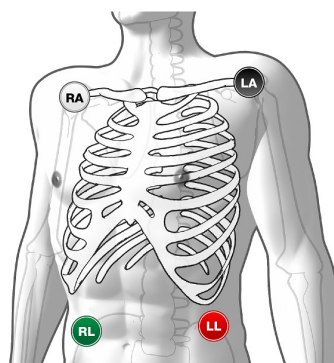
→ Attach the electrodes to the patient using AAMI or IEC cables.



Position of electrode	AAMI	IEC
Right mid-clavicular line under clavicle or right wrist	RA White	R Red
Left mid-clavicular line under clavicle or left wrist	LA Black	L Yellow
Left hip or left ankle	LL Red	F Green

3.3.5 4 lead ECG setup for Pacemaker

→ Attach the electrodes to the patient using AAMI or IEC compliant cables.



Position of electrode	AAMI	IEC
Right mid-clavicular line under clavicle or right wrist	RA White	R Red
Left mid-clavicular line under clavicle or left wrist	LA Black	L Yellow
Left hip or left ankle	LL Red	F Green
Right hip or right ankle	RL Green	N Black

3.3.6 Start-up of the Pacemaker



WARNING

▲ Shock hazard!

Pacing is started immediately when the pacemaker current is increased from 0 mA.

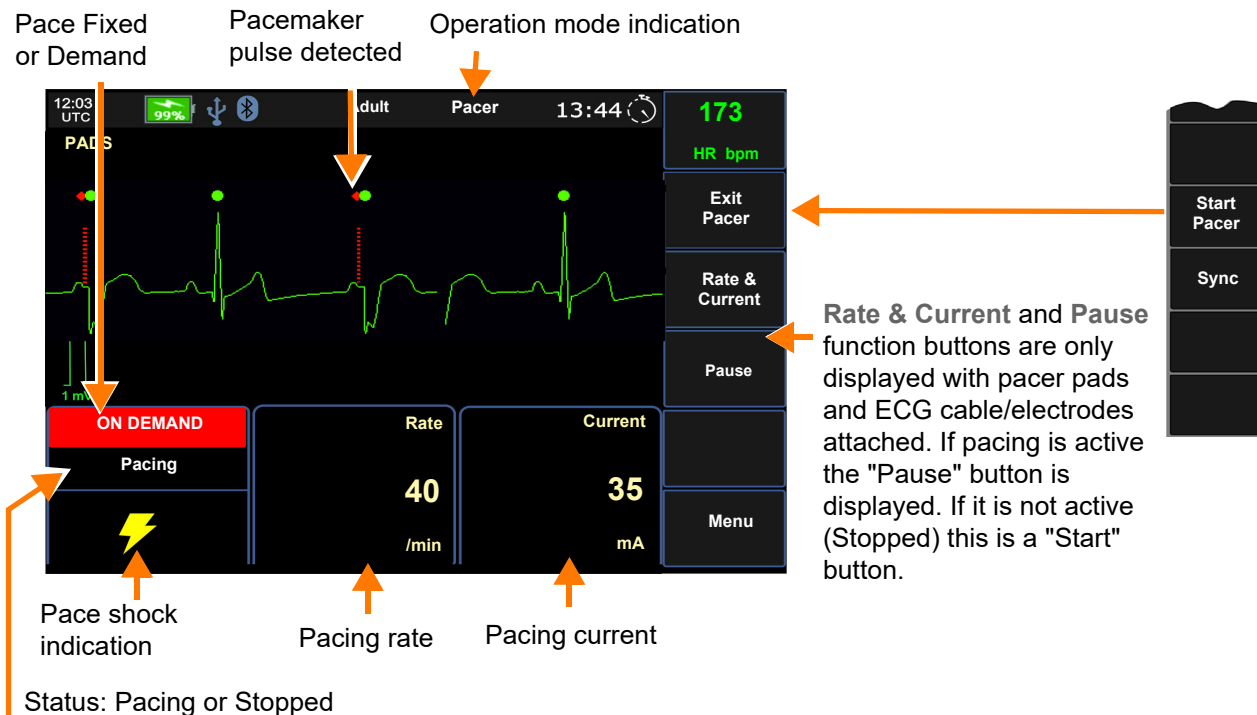


In order to be able to operate the pacemaker, the following conditions must be met:

- Pads and ECG patient cable must be connected to the device.
- When the pacemaker is switched on, the current value is set to 0.
- The device can be switched from defibrillation to pacing mode at any time.
- The device can be switched from pacing to Defibrillation mode at any time by **Exit Pacer** key. In this case, the pacemaker stops
- If the pacemaker operation is closed by pressing the **Exit Pacer** key, the frequency and current settings are saved.
- The function buttons **Rate & Current** and **Start/Pause** are only displayed with pacer pads and ECG cable / electrodes attached.

3.3.7 Home screen Pacemaker

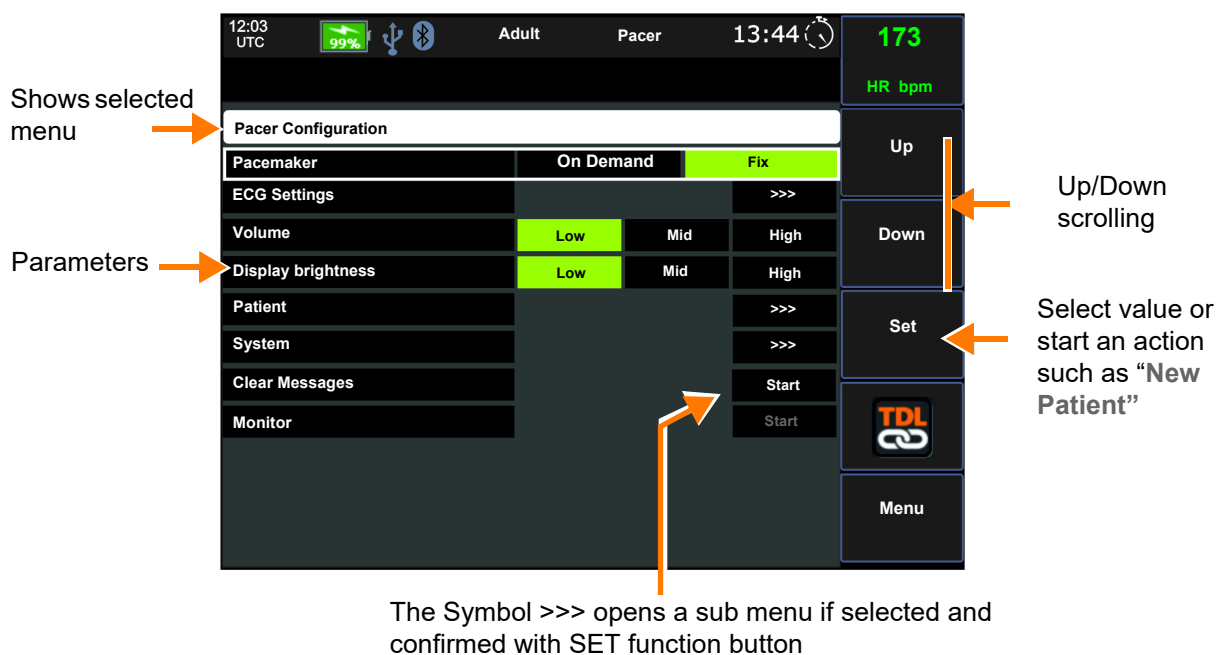
Select the function button **PACER** to display the pacemaker function.



The pacemaker default mode at switchover is "FIXED" mode; the "ON DEMAND" mode has to be selected manually in the Pacer Configuration menu. The default "FIXED" or "ON DEMAND" can be configured in the maintenance menu (see chapter 5.1.3).

Menu

The screen below shows the parameters available for **Pacemaker** mode.



Menu Structure

Mode	Parameter	Sub-Menu >>>Function
Pacer	Volume Display brightness	ECG Settings>>> System>>> Patient >>>

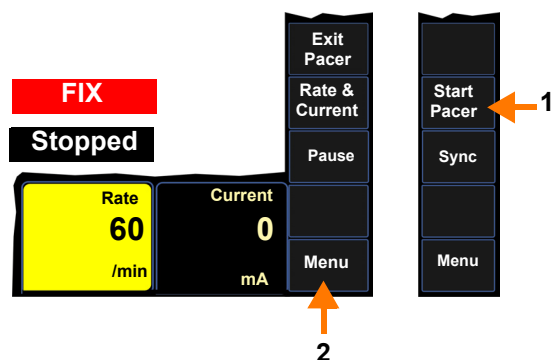
3.3.8 Initial operation pacemaker

PACER Mode

- The Select energy and Charge energy buttons are deactivated.
- Function button for **Rate & Current** setting are available with the pacer pads and ECG cable / electrodes attached.
- Function button **Exit Pacer** to return to MANUAL mode, depending which mode Pacer was invoked from.

3.3.9 Selecting pacemaker mode Fix or Demand

1. Press the **Start Pacer** function button (1) to open the Pacemaker display.
2. Press the **Menu** function button (2) to open the Pacer configuration menu.
3. Select operational mode Fix or Demand.
4. Exit the menu with the **Back** function button.
5. The operational mode is displayed in the pacer red operating mode field.



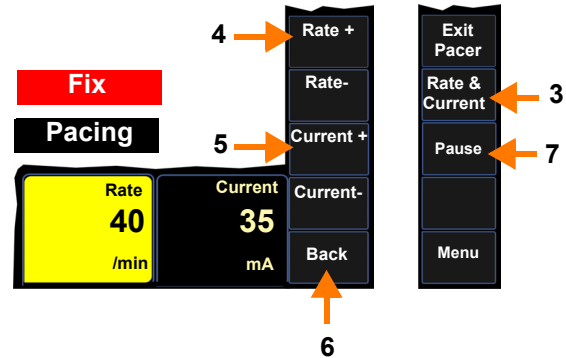
3.3.10 Pacemaker settings operational mode Fixed

3.3.10.1 Fixed mode



The Rate + key is only displayed if the Pacer mode is FIX.

1. Attach the pacer pads (see [page 56](#)).
2. Attach ECG patient cable (see [page 57](#) or [page 63](#)).
3. Display pacemaker and select operational mode Fix.
4. Press the function button **Rate & Current** (3).
5. Select **Rate +/-** (4) to set the impulse frequency.



WARNING

▲ Shock hazard!

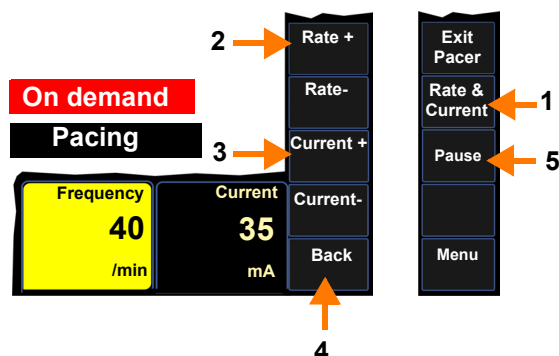
Pacing is started immediately when the pacemaker is switched ON and the current is set.

- ▲ Never touch the pads or the patient's body near the pads while the pacemaker is in use.

6. **Starting the pacemaker**
Press the **Current +** function button (5) to set the impulse current until the heart reacts to the stimulation.
7. Exit the setting with the **Back** function button (6).
8. The pacemaker can be interrupted and restarted by selecting the **Pause** function button (7).
9. Finish the therapy as described in [section 3.2.5 Finishing the therapy, page 52](#).

3.3.11 Pacemaker settings operational mode Demand

1. Attach the pacer pads (see [page 56](#)).
2. Attach ECG patient cable (see [page 57](#) or [page 63](#)).
3. Display pacemaker and select operational mode Demand
4. Press the function button **Rate & Current** (1).
5. Select **Rate +/-** (2) to set the impulse frequency.



WARNING

▲ Shock hazard!

Pacing is started immediately when the pacemaker is switched ON and the current is set.

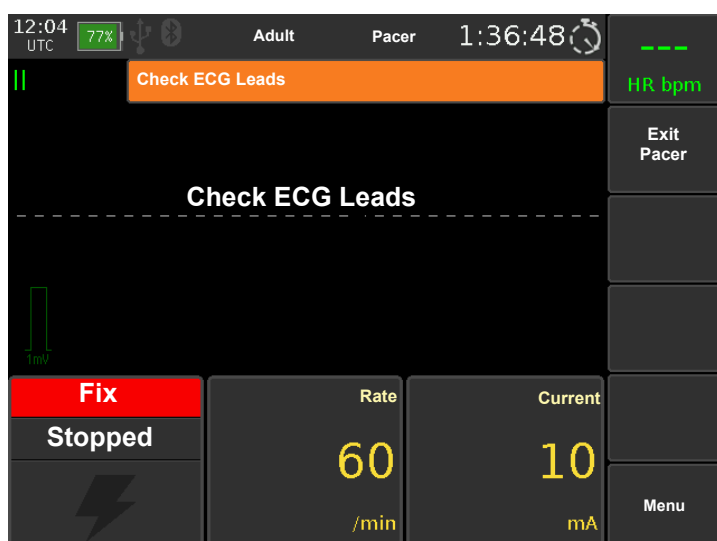
- ▲ Never touch the pads or the patient's body near the pads while the pacemaker is in use.

6. **Starting the pacemaker!**
Press the (3) **Current +** to set the impulse current until the heart reacts to the stimulation.
7. Exit the setting with the **Back** function button (4).
8. The pacemaker can be interrupted and restarted by selecting the **Pause** function button (5).
9. Finish the therapy as described in section [3.2.5 Finishing the therapy](#).

3.3.12 Pacing automatically stopped



In some cases the running pacer stops automatically (see [2.8.2 Technical notification](#), Pacer). If this happens a technical notification is displayed and the Pacer function buttons disappears. To restart the pacer remedy the cause and press function button **Start**.



After remedy the cause for the automatic Pacer stop, the function buttons appears again.

3.4 CPR



WARNING

- ▲ Performing chest compressions can lead to thorax injuries.
- ▲ If the victim is lying on a mattress, chest compressions may be cushioned, leading to a loss in CPR quality. Consider moving the victim on a hard surface for optimal CPR quality.



- The manual defibrillation mode offers a function for a guided CPR with the CPR Sensor.
- Voice prompts can be activated or deactivated in the menu **System > Maintenance Settings > CPR feedback setting**, [see 5.2.4 CPR Feedback Settings](#).

3.4.1 ARGUS Lifepoint sensor



WARNING

- ▲ The sensor may use only by users who are trained in CPR.
- ▲ Inaccuracies in measured values may be seen:
 - if the palm is used instead of the heel of the hand (see picture 1) [3.4.3 Setup of the ARGUS Lifepoint Sensor](#)
 - if the black side instead of red side of the sensor is attached to the adhesive pad
 - if no, expired or stored adhesive pad outside temperature range is used which keeps the sensor in position
 - if patient is lying on a soft surface (e.g mattress). Move the patient to a hard surface for a optimal CPR and measurement quality.
- ▲ Do not rely solely on the values displayed by the feedback sensor. Compare the feedback display with your experience in CPR or the patient's clinical condition recorded by a vital signs monitor (e.g SpO2 or eCO2).
If in doubt about the feedback continue with CPR with your experience in CPR without rely on the feedback display.



CAUTION

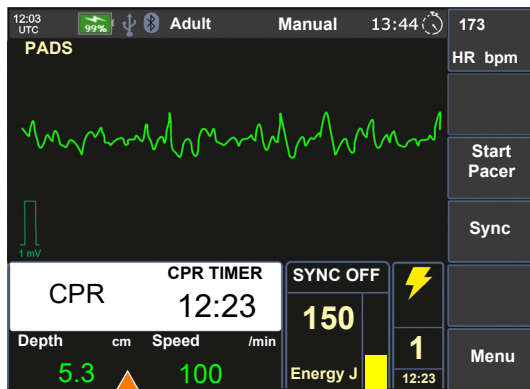
- The ARGUS LifePoint should not be used if any other technique as compression of the chest with the help of the heel of the hand is used.
- The LifePoint is not suitable for use on children younger than 8 years or less than 25 kg.
- CPR feedback option is contraindicated when manual CPR is contraindicated.
- CPR feedback option is contraindicated on pregnant women.



- The range for the depth of compressions is 4.5 to 6.2 cm which is the range for adult patients. There is no recommended target depth for paediatric patients < 8 years or < 25 kg.
- It is recommended to use an adhesive pad so that the sensor remains in position and does not lift off when relieved, which can lead to inaccurate measured values.
- The red side of the sensor must be attached to the adhesive pad.
- In case of difficulty to deliver chest compressions at the recommended rate, follow the pace provided by the metronome.

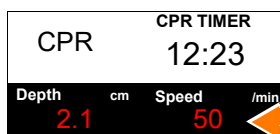
3.4.2 ARGUS Lifepoint measurements

The CPR Sensor measures the compression depth and rate after each compression.

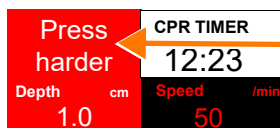


Advice to improve the CPR quality:

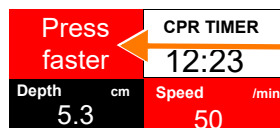
Display of CPR quality in Manual mode:



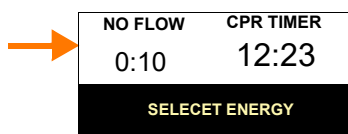
Values out of range are displayed red.



If value "**Depth**" stays out of range, advice to press harder/softer is given.



If value "**Speed**" stays out of range, advice to press faster/slower is given.



If CPR is stopped, "**NO FLOW**" and an up counting timer (minutes/seconds) are displayed and advice is given:

- "Select Energy" in manual mode

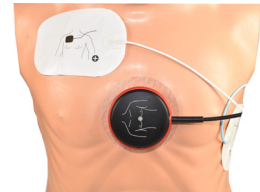
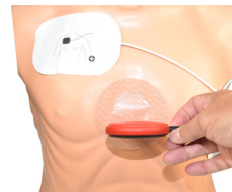
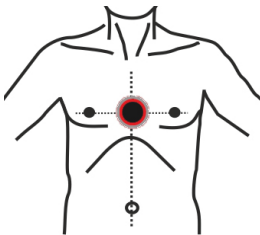
3.4.3 Setup of the ARGUS Lifepoint Sensor



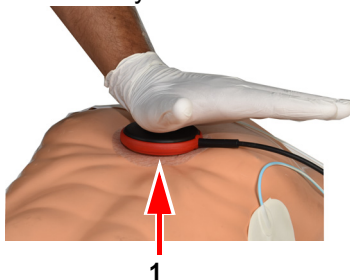
WARNING

- ▲ Only use the securing pads up to their expiration date.
- ▲ Do not reuse the pads
- ▲ Only use sensor and the securing pads on intact skin.
- ▲ Inaccuracies in measured values may be seen:
- ▲ See warning at the beginning of this section [3.4.1 ARGUS Lifepoint sensor](#)

1. Switch on the device.
2. Activate Manual defibrillation with the Exit Pacer or Exit Monitor function button if not already in Manual mode.
3. Connect the CPR Sensor's USB cable to the Tempus LS-Manual USB connector.
4. Place the adhesive pad on the lower third of the breastbone (= middle of the thorax) and remove the white foil.
5. Place the sensor with the red side on the adhesive pad.



6. Place your hand on the sensor so that the heel of your hand **(1)** is in the middle of the sensor.



7. Start with CPR and monitor the compression quality on the device and follow the instructions given by the device (see page before).

The following limits are set by default for speed and depth.

Compression rate per minute [/min]	Press faster	Press slower
100	≤ 90	≥ 120
Depth [cm]	Press harder	Press softer
0.1-12.7	≤ 5	≥ 6.0

Chapter 4

ECG display

This chapter explains the basic principles of operation for continuously attended ECG signal display with the 3 or 4 wire patient cable.

4.1 ECG and heart rate display



WARNING

- ▲ No alarms are produced for heart rate or arrhythmias or asystole. Therefore keep the patient under continuous observation.
- ▲ **False diagnosis!** Only use silver/silver-chloride electrodes if the patient may have to be defibrillated while the ECG is being displayed. Other electrodes may create high polarization voltages and the ECG trace on the display may simulate cardiac arrest.
- ▲ Danger of destroying the device during defibrillation! The device is only type CF protected if the original patient cables are used.



Important

- The guidelines for patient electrode placement are provided as an overview only. They are not a substitute for medical expertise.
- If an electrode is faulty or has come off, the ECG waveform is displayed as a dotted line, an audible notification is issued and notification “ECG LEDs OFF” is displayed. Depending on the setting, the device automatically switches to defibrillation mode in case of attached defib pads. See settings in the menu **System > Maintenance Settings > System Settings > Service Settings > Monitor Settings > Auto leave monitor when** (see [page 85](#)). Settings are:
 - Pads attached (default setting)
 - Never
- Used filter setting during ECG display:
 - HP filter: CPS 0.5 Hz (ST diagnostic)
 - LP filter: MMF 40 Hz

4.1.1 ECG signal with a pacemaker patient



DANGER

- Erroneous HR display. In the continuously attended monitoring of pacemaker patients, the possibility of pacer pulses being counted as QRS complexes cannot be excluded. Therefore, pacemaker patients should always be watched closely because the heart rate from the pacemaker might still be registered in case of a cardiac arrest or some arrhythmias.
- This device will reject double pacer pulses having amplitudes from ± 2 mV to ± 700 mV and pulse widths from 0.1 ms to 2.0 ms synchronised with an ECG or without ECG.
- Pacemaker signals from different pacemakers vary. In the case of cardiac arrests or some arrhythmias, pacemaker signals might still be measured, especially signals from pacemakers with overshoot > 20 ms. Pacemaker patients need to be monitored very closely

When displaying the heart rate of pacemaker patients, it is important that the device will only count the QRS complexes and reject the pacer pulses.

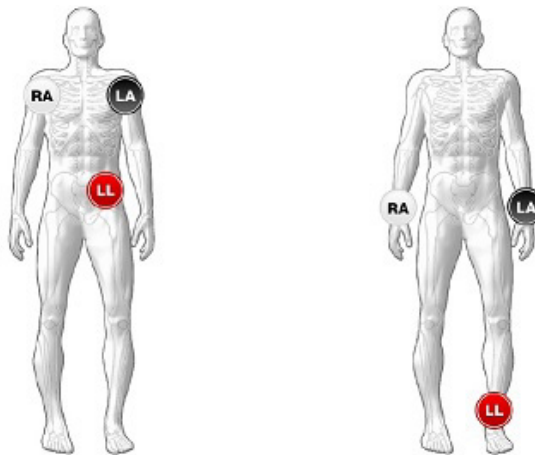
Pacer pulses are represented by a red rhombus above the top ECG curve, randomly, some pacer pulses could be missing on the display.

The device has an electronic pacer pulse suppression algorithm which rejects the pacer pulses so that they are not counted as QRS complexes. Depending on the pacemaker model used and on the position of the electrodes, the compensation pulse following every pacer pulse may be considered as a QRS complex. In this situation and when the pacer pulse is ineffective, the displayed heart rate may lead to a misinterpretation, and the device will not issue an alarm in the case of bradycardia or asystole. Whether or not the compensation pulse is counted as a QRS complex depends on the pacer pulse parameters.

For pacemaker patients, the ECG signal amplitude should be greater than 1 mV.

4.1.2 ECG signal display with 3 leads (3 wires)

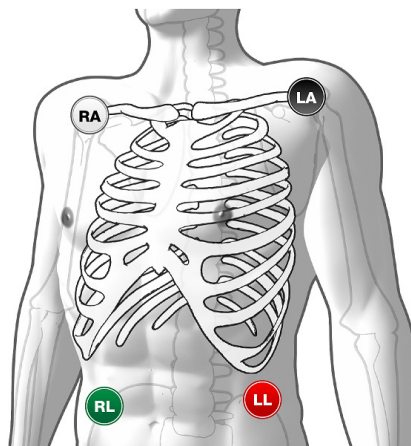
→ Attach the electrodes to the patient using AAMI or IEC cables.



Position of electrode	AAMI	IEC
Right mid-clavicular line under clavicle or right wrist	RA White	R Red
Left mid-clavicular line under clavicle or left wrist	LA Black	L Yellow
Left hip or left ankle	LL Red	F Green

4.1.3 ECG signal display with 6 leads (4 wires)

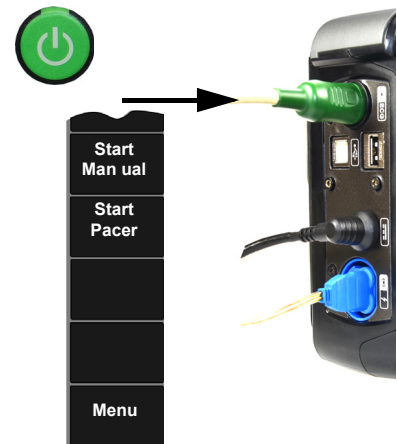
→ Attach the electrodes to the patient using AAMI or IEC compliant cables.



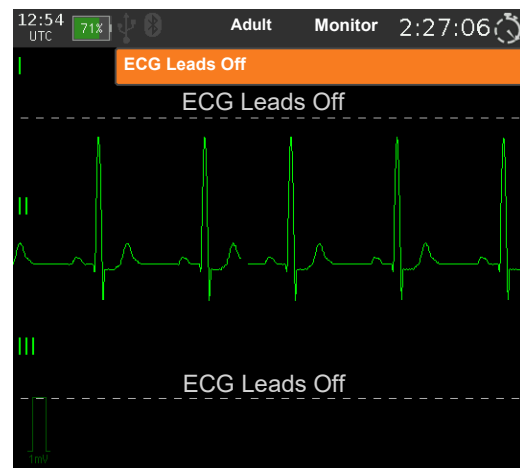
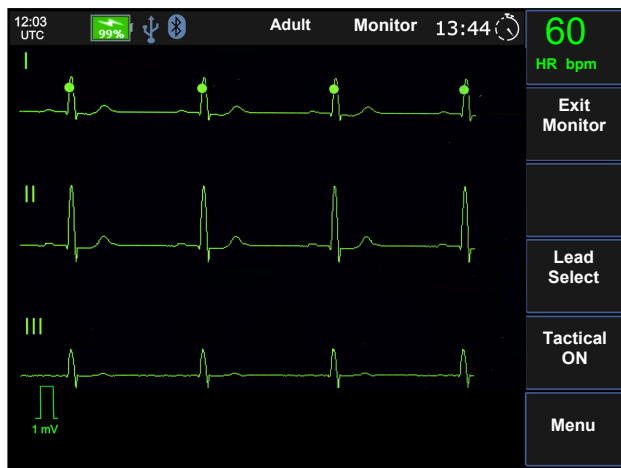
Position of electrode	AAMI	IEC
Right mid-clavicular line under clavicle or right wrist	RA White	R Red
Left mid-clavicular line under clavicle or left wrist	LA Black	L Yellow
Left hip or left ankle	LL Red	F Green
Right hip or right ankle	RL Green	N Black

4.1.4 Start ECG signal display

1. Apply the electrodes as shown in 4.1.2 ECG signal display with 3 leads (3 wires) or 4.1.3 ECG signal display with 6 leads (4 wires).
2. Connect the patient cable to the ECG signal input.
3. Press the Menu function button and select with button “Up” parameter “Monitor mode” and start the ECG signal display mode with the function button “Set”.
4. Press button “Lead Select” to display leads aVR, aVL and aVF.



ECG display



Electrode OFF detection

If an electrode is displaced or an electrode resistance is too high, an audible notification is issued and message “ECG Leads Off” is displayed.

Chapter 5

System settings

This chapter explains the system settings and gives an overview of all parameters.

5.1 Overview settings

5.1.1 Overview settings in the operating modes

The table below show the general settings for the user during operation. Each operating mode (Manual Defi, Pacer and Monitor) has its own setup configuration.

Mode	Menu >>>/Parameter	Function/see details
Manual	• Metronome	see page 77
	• Metronome Ratio	
	• Sync Mode	
	• ECG Settings >>>	see page 78
	• Volume	see page 77
	• Display Brightness	
	• Patient >>>	see 5.2
	• System >>>	see page 79
	• Do Self test	Start
	• Clear messages	Start
	• Monitor	Start (see next page)
Pacer	• Pacer mode	see page 78
	• ECG Settings >>>	see page 78
	• Volume	see page 77
	• Display Brightness	
	• Patient >>>	see 5.2
	• System >>>	see page 79
	• Clear Messages	Start
	• Monitor	Start (see next page)
Monitor	• ECG Settings >>>	see page 78
	• Volume	see page 77
	• Display brightness	
	• Patient >>>	see 5.1.5
	• System >>>	see page 79
	• Clear messages	Start

5.1.2 User settings manual mode



User setting are automatic stored

Default values are **bold**

Menu>>>/Parameter	Value	Description
Metronome	• On/Off	Switching the metronome On/off
Metronome ratio	• 30:2 • 15:2 • Cont	• 30:2 for adult • 15:2 for children • Without rescue breath choose Continuous
Sync mode	• On/Off • Auto/Off	Switching Sync mode to On/Off or Auto Auto/Off is displayed when parameter "Auto Sync Enable" in the menu System/Maintenance Setting/Manual Setting is set to Yes.
ECG Settings >>>	>>>	see page 78
Volume	Low /Mid/High	Select the volume above the environmental noise (50, 60 or 70 dB)
Display brightness	Low /Mid/High	--
Patient >>>	>>>	see page 78
System >>>	>>>	see page 79
Do self test	Start	Start all self test
Clear messages	Start	Clears messages displayed in the status line
Monitor	Start	Starts monitoring mode

5.1.3 User settings Pacer



User setting are automatic stored

Default values are **bold**

Menu>>>/Parameter	Value	Description
Pacemaker mode	- On Demand - Fix	Selecting Fix or demand mode see 3.3.9 .
ECG Setting	>>>	see 5.1.4
Volume	Low /Mid/High	Select the volume above the environmental noise (50, 60 or 70 dB)
Display brightness	Low /Mid/High	---
Patient	>>>	see 5.1.5
System >>>	>>>	see page 79
Clear message	Start	Clears messages displayed in the status line
Monitor	Start	Starts monitoring mode

5.1.4 User ECG Settings

Parameter	Value	Description
ECG amplitude (mm/mV)	5/ 10 /20 mm/mV	--
ECG wave speed (mm/s)	12.5/ 25 /50 mm/s	--

5.1.5 User Patient Settings

Parameter	Value	Description
Patient Type	Adult / Pediatric	This is used to override the energy setting adult when using Adult defibrillation electrodes with children. The energy will be set to pediatric default energy in Manual mode. In Manual mode the max. selectable energy is 100 joules.
New Patient	Start	see page 28

5.2 System, maintenance and service settings



All System, maintenance and service settings are in the Sub-menu System.

The maintenance setting menu is passkey protected. Changes in the maintenance menu must be stored, see “**System > Maintenance Settings> Default Settings Storage >>> Store Defaults**”

Menu System >>>	Parameter/Sub- Menu >>>	Sub-Sub Menu >>>/ Parameter	Description
System >>>	Tactical Mode	ON/OFF	Switching the tactical mode ON/OFF when menu button “Tactical ON/OFF” is not displayed on the main menu. (This parameter ins only displayed when parameter “Tactical Mode Switch” is “Yes”, see page 84)
	Switch USB port	Device/Auto	Device USB
	Intervention Management >>>	Selective Export/Removal >>> - Export all unexported - Export all - Remove all exported - Remove all - Free Storage	Select for export/Select for removal. Select “Start” to Export-/Removal selected files. Showing storage capacity in %
	Device info >>>	- S/N - SW Version - HW Version - SW Version Defi - HW Version Defi Default setting info >>> - Address - UFN Battery Info >>>	- Series number - Software version - Hardware version CPU - Software version Defi - Hardware version Defi - Display of the used default settings file with file name version and description - MAC Address - User Friendly name (TempusLS + S/N) - Various information: Battery version, Full and Actual capacity, voltage, current, safety state, cycle count, temperature, UPS battery state

continue next page

Menu System >>>	Sub-Menu/Parameter	Sub-Sub Menu >>>/Parameter	Description
System >>>	Device info >>>	- Ref. no. - Guidelines	
	Maintenance Settings >>>	<i>This menu is only accessible with the passkey</i>	Enter the 4 digit passkey
		Organization identification >>>	Add here the information to assign the device to an organization /user
		Mains Filter	OFF/50 Hz/ 60 Hz
		Manual Settings >>>	See detail 5.2.1 Manual Settings
		Pacer Settings >>>	See detail 5.2.2 Pacer Settings
		Metronome Settings	See detail 5.2.3 Metronome Settings
		CPR Feedback Setting >>>	See detail 5.2.4 CPR Feedback Settings
		Print/Event settings >>>	See detail 5.2.5 Print/Event Settings
		System Settings >>>	See detail 5.2.6 System Settings
		Default Settings Storage >>>	See detail 5.2.7 Default settings storage
		Log file export >>>	See detail 5.2.8 Log file export

5.2.1 Manual Settings

Menu **System** > **Maintenance Settings** > **Manual setting**



WARNING

▲ The setting **Auto Sync Enabled** and **SYNC ON after shock** must be communicated to the user.

Parameter	Value	Description
Default Energy Adult	150 joules	Preset of defibrillation energy when starting device with adult electrodes connected.
Default Energy Pediatric	50 joules	Preset of defibrillation energy when starting device with pediatric electrodes connected.
Auto Sync Enabled	Yes/No	If set to "Yes" synchronised mode will be activated as soon a QRS trigger is detected. See 3.2.2 Setup switching from unsynchronised to synchronised mode
Sync soft-key	Yes/No	If set to "Yes" the user can switch between synchronised/direct defibrillation If "No" is selected the Sync mode can be activated only via the manual configuration menu.
SYNC ON after shock	Yes/No	If set to "No" the Sync mode is set to Off (direct defibrillation) after a shock has be released in synchronised mode. Note, this function is only true if Auto Sync Enable is set to "No"
Start metronome default	On/Off/CPR	If set to "ON" the metronome is started as soon Manual mode is ready. If set to "CPR" the metronome is started as soon CPR feedback sensor is connected.
Metronome ratio default	30:2/15:2/Cont	30:2 for adult 15:2 for children - Without rescue breath choose Continuous

5.2.2 Pacer Settings

Menu **System > Maintenance Settings >Pacer setting**

Parameter	Value	Description
Pacer enabled	Yes /No	Enabling pacer function
Default Pacer mode	On Demand/ Fix	Selecting preferred Pacer mode
Default Pacer Rate	60 p/m	Selecting of the default pacer rate at start. 40/50/ 60 /70/80...180 pulse/minute
Pacer Key in Manual	Yes /No	Pacer key will be displayed in Manual Defibrillation when Yes is selected. Default = Yes

5.2.3 Metronome Settings

Menu **System > Maintenance Settings >Metronome settings**

Parameter	Value	Description
Metronome Rate	100	Setting of the desired metronome rate

5.2.4 CPR Feedback Settings

Menu **System** > **Maintenance Settings** > **CPR feedback setting**

Parameter	Value	Description
Rate limit upper (cpm)	120	The CPR rate limits are fixed. see section 3.4
Rate limit lower (cpm)	100	
Depth limit upper (mm/inches)	60 mm / 2.36 inches	The Depth limits are fixed. see section 3.4
Depth limit lower (mm /inches)	50 mm / 1.97 inches	
Feedback delay (sec)	15	Delay time till a new feedback is displayed
Voice prompts on Manual	Yes/ No	Following voice prompts are given: Press harder Press softer Press faster Press slower Recoil (dependent on selected country, not for DE/FR/UK/USA)
Average rate max cpr	5	Number of measurements to calculate the average compression rate.


 cpm = compressions per minute

5.2.5 Print/Event Settings

Menu **System** > **Maintenance Settings** > **Printer/Event settings**

Parameter	Value	Description
Print on shock	Yes/ No	-
Print on start pacing	Yes/ No	-

5.2.6 System Settings

Menu **System > Maintenance Settings > System Settings**

Menu	Sub-menu >>>/Parameter	Value/Description
	QRS marker default	Yes/no
Ready-to-use Settings>>>	- Ready-To-Use - Interval for Test - Do Self Tests - Do Relay Test - Do IGBT Test - Do Battery Test - Capacitor Test	On/OFF Daily/Weekly/Monthly - Start of all tests - Start of individual test
Default System Settings>>>	Start up view	Manual
	Default Display Brightness	Low/Mid/High
	Default Volume	Low/Mid/High (50, 60 or 70 dB)
	Default ECG Amplitude (mm/mV)	5/ 10 /20 mm/mV
	Default ECG Speed (mm/s)	12.5/ 25 /50 mm/s
	Auto Switch Off	15/ 30 min. or never
	Units Settings	Metric or Inches °C or °F
Tactical mode settings>>>	- Tactical mode switch - NVG brightness control - Audio control - Wireless control	If “Yes” the Tactical ON/OFF switch appears in Defibrillation and monitoring mode. If “No” the Tactical mode can be programmed with Menu System> Tactical mode> ON/OFF (see page 27) The night vision google brightness dimming incl. LED OFF, Audio OFF and Wireless module off can be selected with Yes or No.
Communication setting >>>	- Wireless communication - Wired communication - Switch USB port	Switching ON/OFF of the wireless and wired communication USB port Auto: - selects automatic the docking or the device USB port USB port Device: - the USB port on the connection panel is active.

Menu	Sub-menu >>>/Parameter	Value/Description
Language	Language selection table	Use button Next/Prev/Set to select and program the desired language.
Date, Time, Timezone>>>	Time format	12h/ 24h
	Time hour/minutes	Set time
	Date day/ month, year	Set date
	Timezone >>>	Set time zones
Software Installation>>>	Install Firmware and bootloader data. Sub menu SW version >>> shows installed software versions	Start
Maintenance Passkey>>>	---	Definition of the maintenance pass key
Service Settings>>	Log File reset	Deleting the log file
	Monitor Settings >>>	Auto leave monitor when: - Pads attached - Never
	Metronome Settings	Breath Time 1, 2 or 3 seconds
	Power report >>>	Information about the battery and power source
	License Settings >>>	Activating or deactivating modes and sensors
	ECG Cable Info	Cable info of the attached ECG cable
	Impedance	Measured impedance of the defibrillation pads
	Last System Event	--

5.2.7 Default settings storage

Menu **System > Maintenance Settings > Default settings Storage**



To activate the changes and stored default setting, cycle power off and on.



CAUTION

In order to guarantee the Cyber security of the **Tempus LS-Manual**, RDT recommends the following:

- ▲ Installing the latest antivirus/firewall programs on the host in order to prevent malware on the USB stick from affecting the **Tempus LS-Manual**.
- ▲ Regularly installing security updates on the host.

Parameter	Value	Description
• Store defaults	Start	Any change in the maintenance menu must be stored with this function. A reminder message in the message bar appears "Defaults setting changed but not saved". To activate the stored default setting cycle power off and on.
• Restore defaults	Start	Restores the default setting
• Restore factory defaults	Start	Restores the factory defaults and activates the initial setting screen appears during the first start up and the RTU display is set to off. (see "Initial settings" on page 24)
• Export settings	Start	Connect a USB memory stick to the device. Press start. The progress is displayed in the message bar.
• Import settings	Start	Copy the file into the following directory of the USB memory stick: Tempus LS/Settings. Connect the USB memory stick to the device. Press start. The progress is displayed in the message bar. To activated the new defaults cycle power off and on.

5.2.8 Log file export

Menu **System** > **Maintenance Settings** > **Log file export**



Export of log files to a USB memory stick may take very long depending of the size of the log file. Therefore, a number of selections are available.

Parameter	Value	Description
• Short	Start	Export of a log file generated within the last 30 seconds. Depending of the number of log files the time frame of exported files can be various.
• Last 12 hours	Start	Export 12 hours log files
• Last 24 hours	Start	Export 24 hours log files
• Complete	Start	Export all available log files

Chapter 6

Daily checks and Maintenance

This chapter covers day-to-day maintenance and cleaning of the **Tempus LS-Manual**. There is little maintenance which the user is expected to perform, as most must be carried out by an RDT trained engineer.

6.1 Daily check and Maintenance interval



The unit must be serviced on a regular basis. The test results must be recorded and compared with the values in the accompanying documents.

Maintenance work described in this chapter may be performed by a qualified technician or by the user according to the Maintenance and Interval Table below.

The following table indicates the intervals and responsibilities of the maintenance work required. Local regulations in your country may stipulate additional or different inspection intervals and tests.

6.1.1 Maintenance interval table

Interval	Maintenance	Responsible
Daily	- Visual inspection of the device and accessories (see section 6.2.1) - Each day, before turning on the device, check the Ready-to-Use indicator light (see section 2.7.1). If necessary (no indicator light), manually run the self-test (see section 6.2.2) - Battery check (see section 6.2.3) - Button and alarm test (see sections 6.2.4)	User or User's organization
Weekly	- Defibrillation test (see section 6.2.5) - ECG signal test (see section 6.2.6)	User or User's organization
Every 12 months	- Measuring and safety checks and inspections according to the instructions in the maintenance manual - Defibrillator measurement check	Service staff authorised by RDT
Limited life item replacement	<i>The following parts must be checked and replaced if necessary</i> - Replace the power battery, see section 6.3.1. <i>The following maintenance are checked during the 12 months service interval (see above) and described in the maintenance manual:</i> - Replace the hot swap battery - Replace the internal button cell (every 10 years) - Replace the defibrillation capacitor (if the released energy deviates more than 15% from the intended value)	Service staff authorised by RDT
Wear parts	- Handle replacement 6.4.1 - Battery cover and handle see section 6.4.2 - Dust covers see section 6.4.3 - Rear clip see section 6.4.4	User

6.1.2 Service/Shelf life

Device

- The device has a service life of 10 years.
- Power battery (approx. 5 years after first use) for details see section [6.3.1](#)
- Hot swap battery (approx. 5 years after first use) for details see section [6.3.1](#)
- Button cell (approx. 10 years)

Accessories shelf life

- Electrodes pads (approx. 3 years), see expiry date on the pouch.
- CPR feedback sensor securing pads (approx. 2 years), see expiry date on the product labeling.

6.2 Functional test

A detailed description of the maintenance steps is listed in table [6.1.1](#). Enter the results in the check list in the section [6.6](#).

6.2.1 Visual inspection of the device and accessories

Check the device and accessories for the following:

- Sufficient number of all required disposables available?
- Check handles, connectors and keypad for wear.
- Device housing undamaged?
- Electrode connection undamaged?
- Defibrillator / pacemaker pads available?
- Check the expiration date on the pads package.



WARNING

- ▲ Defective units or damaged cables and damaged or expired accessories must be replaced immediately.

6.2.2 Self tests



The device has an integrated self-test. During this test the relay, battery and defibrillation capacitor are tested.

These tests can be executed in the menu **Manual configuration/Do Self -Tests**.

The results are displayed in the message area. Following tests are executed:

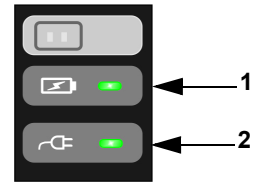
- Relay test
 - IGBT test
 - Battery test
 - Capacitor test
- Remedy of failed test see ["General errors & troubleshooting" on page 109](#)

These tests correspond to the same tests that are performed during the RTU test. When the unit is switched off after a failed test, the RTU LED status is reactivated see ["Ready to use LED" on page 33](#).

6.2.3 Battery check

1. Connect the unit to the power supply and switch it on. The start screen is displayed.
2. The external DC voltage indicator (2) is lit.

- When the battery indicator LED (1) lights green, the battery is being fast charged. Check the charging status once the indicator goes off.
- The battery indicator LED (1) is **off** when the battery is not being fast charged.



3. Check the top left corner of the display for the battery charge status.



4. If the charge is 10% or lower, change the battery, see [page 31](#).
5. Spare battery check see [page 30](#).

6.2.4 Defibrillator keys and alarm test

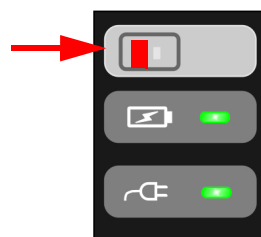


All needed keys for defibrillation will be tested. This function test is only possible in manual mode. The function will be tested by detecting **key stroke** during cycling power on.

For the device testing, use one of the following simulators:

- Tempus LS Defib Simulator
- Tempus LS DSD Simulator

1. Switch on the device.
2. Use the  button to increase/decrease energy level.
3. Cycling power off/on while pressing the  button. The RTU LED is red flashing red, audible alarm is issued and after 5 second the notification **Key stuck** detected appears. Release  button and RTU LED switches off.
4. Cycling power off/on while pressing the  button. The RTU LED is red flashing, audible alarm is issued and after 5 second the notification **Key stuck** detected appears. Release  button and RTU switches off.
5. Switch the device off.



If the device does not behave as described in this user guide, contact RDT_Techsupport@philips.com.

6.2.5 Defibrillation test



- Use a simulator that displays the received energy level.
- Shock release via the electrode connector is done by means of the simulator.
- The LED indicators corresponds roughly to the energy (low to high) emitted by the device; however, the DSD simulator must not be used to perform measurement checks.

For the device testing, use one of the following simulators:

- Tempus LS Defib Simulator
- Tempus LS DSD Simulator

1. Switch on the device.
2. Connect the simulator to the electrode connector.
3. Select the required energy (150 J) with the  button.

4. Initiate the energy charging by pressing "Charge"  button.



DANGER

▲ Danger of electric shock!

- Make sure that the connection cable between the DSD simulator and the defib pads connector of the Tempus LS-Manual is fitted correctly.

5. As soon the shock button lights up, release the shock with  button on the device.
6. Check that one of the upper LED on the simulator is lit.
7. Switch the device off.



If the device does not behave as described in this user guide, contact
RDT_Techsupport@philips.com.

6.2.6 ECG display test



This test is performed on a volunteer or with a ECG simulator

1. Apply the electrodes as shown in [4.1.2 ECG signal display with 3 leads \(3 wires\)](#) or [4.1.3 ECG signal display with 6 leads \(4 wires\)](#) or use a ECG simulator.
2. Connect the patient cable to the ECG signal input.
3. Press the Menu function button and select with button "Up" parameter "Monitor mode" and start the ECG signal display with the function button "Set".
4. Check the ECG signal by pressing button "Lead Select" to display all leads aVR, aVL and aVF.
5. Remove one lead and check that the audible notification is issued and message "ECG Leads Off" is displayed.

6.2.7 Pacemaker and ECG lead test



Pacer pulse release via the defibrillator output. This is done by means of the DSD shock detector.

-
- 2
- 4
- 3
- 1

6.3 Maintenance interval of the batteries



Important

- The battery's performance and life largely depend on how and under which ambient conditions the battery is used.

Power Battery

- The rechargeable power battery is maintenance-free during its normal life.
- The battery must be replaced approx. every 5 years after first use, for details see section [6.3.1](#).
- If a battery is not used, recharge it every 6 months.
- Recommendation: Store the battery with a state of charge between 50-70%.
- Check battery contacts for corrosion.
- Make sure that not used batteries are stored in a protective case, to prevent short circuit with conductive parts and the battery contacts.

Hot swap batteries

- The hot swap battery is maintenance-free during its normal life.
- The hot swap battery must be replaced approx. every 5 years after first use or when the device runs less than 2 minutes when the power battery is removed.

6.3.1 Replacing the batteries



WARNING

- ▲ Replacement of lithium batteries by inadequately trained personnel could result in a hazard.

Replacing the power battery:

The power battery needs to be replaced when the battery capacity indication in the menu **System > Device Info > Battery info**, parameter “**Full Charge Capacity**” or “**Cycle Count**” is:

- below 4000 or more than 500 Charging cycles (Battery 01-3011)
- below 4400 or more than 500 Charging cycles (Battery 01-3030)

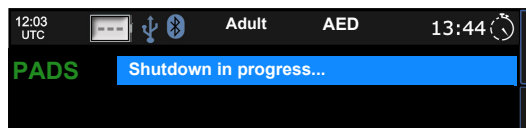
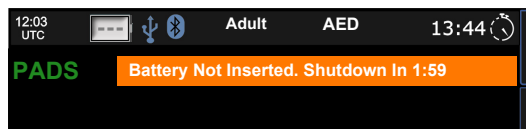
Replacing hot swap battery:



Perform the internal battery check on a yearly base

If the internal battery check fails (shutdown is performed before counter reaches 0:00), contact your service representative.

1. Switch on the device
2. While the device is running, remove the rechargeable battery.
3. The current status is displayed
 - Visually check that the counter is reaching 0:00 before the device is shutting down.
4. When the counter reaches 0:00 the device is shutting down.



6.3.2 Battery disposal



DANGER

- ▲ Danger of explosion! Battery must not be burned or disposed of with domestic refuse.
- ▲ Danger of acid burns! Do not open or heat up the battery.



- ▲ The battery is to be disposed of in municipally approved areas.

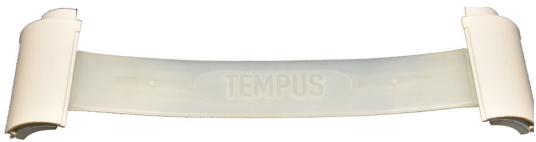
6.4 External servicing



The following parts can be replaced by the user. Important is to use always a Torque driver to tighten the screws.

6.4.1 Handle replacement

Parts and tools required

Parts and tools	Part number SAG / RDT / Philips	Picture
Service KIT 8 Handle	3.940598 / 26-5007 / 989706012300	Note: This Kit number includes all part numbers listed below:
Handle	4.435388	
Handle fitting right Handle fitting left	4.310670 4.310671	
2 screws M3x35, T10	4.910269	--
Torque driver set to 0.8 Nm	N/A	
T10 TORX	N/A	

Procedure

1. Remove the 2 screws.
2. Remove the handle fittings and replace the handle
3. Use a drop of silicon oil to slide the cover back again.
4. Tighten the screws with a torque of 0.8 Nm.



6.4.2 Battery cover replacement

Parts and tools required

Parts and tools	Part number SAG / RDT / Philips	Picture
Service KIT 9 Dust cover battery	3.940599 / 26-5008 / 989706012310	Note: This Kit number includes all part numbers listed below:
1x Cover 1x Metal fixing plate 10 Screws M 2.5x5 T8	4.435386 4.415871 4.914079	
Torque driver set to 0.6 Nm	N/A	
T8 TORX	N/A	

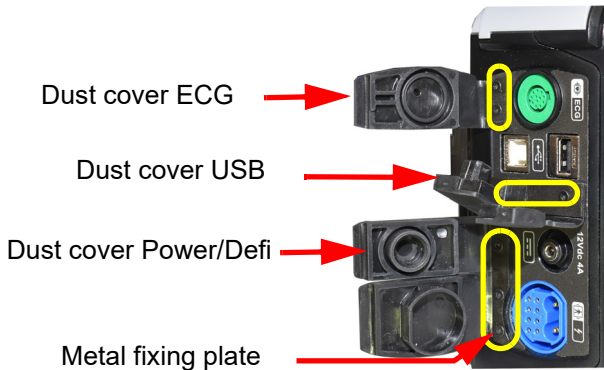
Procedure

1. Remove the 3 screws.
2. Replace the cover
3. Tighten the screws with a torque of 0.6 Nm.



6.4.3 Dust cover fitting/replacement

Parts and tools required

Parts and tools	Part number SAG / RDT / Philips	Picture
Service KIT 12 Dust covers	3.940585 / 26-5011/ 989706012340	Note: This Kit number includes all part numbers listed below:
1x Dust cover ECG 1x Metal fixing plate ECG 1x Dust cover USB 1x Metal fixing plate USB 1x Dust Cover DC/Defi 1x Metal fixing plate DC/Defi 7x Screws M 2.5x3 T8	4.435382 4.415868 4.435385 4.435869 4.435384 4.415870 4.910275	
Torque driver set to 0.6 Nm	N/A	
T8 TORX	N/A	

Procedure

1. Remove all 7 screws (yellow).
2. Fit dust covers and metal plates.
3. Tighten the screws with a torque of 0.6 Nm.



6.4.4 Rear clip replacement

Parts and tools required

Parts and tools	Part number SAG / RDT / Philips	Picture
Service KIT 10 Rear clip	3.940587 / 26-5009 / 989706012320	Note: This Kit number includes all part numbers listed below:
1x Rear clip	3.940575	
Torque driver set to 0.6 Nm	N/A	
T10 TORX	N/A	

Procedure

1. Remove all 4 screws (yellow).
2. Remove the rear clip.
3. Fit the new rear clip.
4. Tighten the 4 screws with a torque of 0.6 Nm.



6.4.5 Wear parts

Inspection	Results	Replaced			
Battery cover	Replace it when cover does not close	☐	☐	☐	☐
Handle	Replace it when it is worn out, dirty or has cracks	☐	☐	☐	☐
Dust covers connectors	Replace it when cover does not close	☐	☐	☐	☐
Rear clip	Replace it when it has cracks or when the rear bracket is broken	☐	☐	☐	☐
	Date of inspection:				
	Inspector:				

6.5 Cleaning



Cleaning removes dust, dirt and stains; however, this does not constitute a disinfection. Use commercially available detergents intended for clinics, hospitals and practices.

6.5.1 Cleaning agents

Please refer to the manufacturer's information regarding the detergents.

Recommended cleaning agents

- Isopropyl alcohol 50%
- Propanol (50%)
- Aldehyde (2-4%)
- Ethanol (50%)
- Neutral detergents
- Soap water
- All other products that are suitable for PC plastic

Cleaning agents not allowed

Never use products containing the following:

- Ethyl alcohol
- Acetone
- Hexane
- Ethylhexanol
- Plastic-dissolving products
- Organic solvents
- Ammonia-based detergent
- Abrasive cleaning agents
- 100% alcohol, Virex, Sani-Master
- Sani-Cloth®, Ascepti® or Clorox® wipes, HB Quat®
- Conventional cleaner (e.g. Fantastic®, Tilex® etc.)
- Conductive solution
- Solutions or products containing the following ingredients:
 - Acetone, Ammonium chloride, Betadine, Chlorine, wax or wax compound, Ketone, Sodium salt

6.5.2 Cleaning the device and ECG patient cable and CPR Sensor



WARNING

- ▲ Remove the battery and close the cover before cleaning. See section [2.6.3 Interruption of external power supply](#) and close the connector with the protective cap.
- ▲ Do not immerse the unit nor the cable in liquid and do not sterilise them!
- ▲ Do not apply tension to the sensor cable.
- ▲ Do not use aggressive cleaners.
- ▲ Do not use any phenol-based agents or peroxide compounds for cleaning.
- ▲ Observe the manufacturer's notes when cleaning the sensors and cables.

Device

1. Disconnect the device from the mains and remove the plug and sensors.
2. Wipe the equipment, with a dampened cloth and a mild cleaning solution see [section 6.5.1 Cleaning agents, page 104](#).
3. Dispose of single-use pads and protective coverings according to the relevant regulations.

ECG cable

- The cable can be wiped with a mild cleaning agent or with 70% alcohol.

CPR Sensor

- The sensor and cable can be wiped with the detergent and disinfectants listed below:



With time, the casing may become less resistant if an alkaline cleaner or a cleaner with a high alcohol concentration is left for a long time on the surface, or if a warm disinfectant or detergent is used. For this reason, Schiller AG recommends using only cleaning agents with alcohol content that are adequate for sensitive materials such as TPU or PU, at room temperature (approx. 20 °C).

Approved detergents

- Isopropyl alcohol (50 %); neutral, mild detergent (wipe and rub dry)

Recommended disinfectants:

- Bacillol® 30 foam/ Bacillol® 30 Tissues
- Mikrozyd® AF
- Meliseptol® Foam pure/ wipes
- RTU Wex-Cide®
- 10% bleach/water solution

6.5.3 Check and cleaning the battery contacts

1. Remove the battery and check the battery contacts for dust or sand.
2. Wipe the contacts with a cloth. Do not use corrosive cleaning agents.

6.5.4 Disposal at the end of the device's useful life



This unit must be disposed of in a municipally approved collection point or recycling centre when no longer used.

If no such collection point or recycling centre is available, you can return the unit to your distributor or the manufacturer for proper disposal. In this way, you contribute to the recycling and other forms of utilisation of old electrical and electronic equipment. Improper disposal harms the environment and human health due to the presence of dangerous substances in electrical and electronic equipment.

6.6 Inspection and checklist tables

In accordance with the maintenance interval detailed previously, the following check list should be copied and followed.

Checking life-saving functions

The following tests need to be performed before or after each intervention, respectively. Enter the results in the check list.

- Visual inspection of the device and accessories (see section 6.2.1).
- Battery charging status (see section 6.2.3).
- Button test (see sections 6.2.4)

Year	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Jan.																															
	Feb																															
	Mar																															
	Aprl																															
	May																															
	Jun																															
	July																															
	Aug																															
	Sep																															
	Oct.																															
	Nov																															
	Dec																															

6.6.1 Every 12 months

Inspection	Results	Inspection			
Functional, safety checks and inspections Confirm the date of the last factory inspections and tests	Return the unit to your nearest authorised service point or your RDT agent for safety and functional checks.	☐	☐	☐	☐
	Date of inspection:				
	Inspector:				

6.6.2 Limited life item replacement every 5 - 10 years

Inspection	Results	Replaced			
Battery Replace battery	The battery needs to be replaced:				
	when the “Full Charge Capacity” is less than 4000/4400, see section 6.3.1 .	☐	☐	☐	☐
	Replace the hot swap battery when the running time of the device is below 2 minutes when the power battery is removed.	☐	☐	☐	☐
	Replace the internal button primary cell (every 10 years)	☐	☐	☐	☐
	Date of inspection:				
	Inspector:				
Defibrillation capacitor Replace defibrillation capacitor	Send the unit to your nearest RDT service centre for capacitor replacement if the defibrillation capacitor deviates more than 15% [joule] from the intended value.	☐	☐	☐	☐
	Date of inspection:				
	Inspector:				

6.7 Error detection



Forced shutdown procedure

If it is not possible to get the device back into the normal operating condition, follow this procedure:

- Press and hold the green button  until the device has switched off. Then switch on again.
- If the device does not return to normal operating condition within a reasonable period of time, continue cardiopulmonary resuscitation.

6.7.1 General errors & troubleshooting

Error	Cause	Remedy
The screen is not lit when the device is switched on	• Battery not inserted correctly or defective	→ Insert battery correctly or replace it
	• Battery empty	→ Connect to the power supply (docking station) and charge battery
	• The device is defective	→ Replace device
Device cannot be switched off	• Software hangs	→ Keep the green button pressed till the device switches off
	• The device is defective	→ Replace device
ECG signal disturbed	• ECG signal interference through electromagnetic waves or discharges see picture page 113	→ Turn off source of signal interference. e.g. radio equipment or cell phone, electrical bed drive or move patient outside field of interference.
Unable to deliver shock	• Electrode error caused by resuscitation measures	→ Reapply electrode
	• Battery empty or defective	→ Replace battery with a fully charged.
	• The device is defective	→ Replace device
Battery cannot Be charged (High/Low Temperature)	• Temperature in the device or battery too high/low	→ Let device cool down, if possible; charging is continued once the temperature has reached an acceptable level.
Test Not Executed Due to Connected Electrodes	• Electrodes are connected during automatic RTU self-test	→ Disconnect electrodes and execute a manual RTU self-test.
Relay test failed	• Relay defective	→ Replace device
IGBT test failed	• IGBT defective	→ Replace device
Capacitor test failed	• Capacitor defective	→ Replace device

Error	Cause	Remedy
Battery test failed	Battery not sufficient capacity or defective	→ Recharge battery, check battery → Replace battery

6.7.2 Technical alarms, notifications



- The following technical alarms and notifications indicates that the device is defective and must be repaired.
- All other alarms that can be resolved by the user are described in the section [2.8 Display of technical alarms and notifications](#).

High priority technical alarms

Alarm message	Description
The device must be repaired if the following messages appear:	
Battery defect. Shutdown in m:ss	Battery defect, replace battery
DPM Hardware failure	Hardware failure of the DPM, device defect
Internal Discharge. Defibrillator Failure	- DPM error INT. DISCH 6 (current 0 or >105A) - DPM error INT. DISCH 8 (voltage capacitor not valid) - DPM error INT. DISCH 9 (voltage capacitor too high)
Internal Discharge. Charging Not possible	DPM error INT. DISCH 4 (charging time too long)
Key stuck detected	- Pressed or short circuit of a soft button detected → Restart device again and make sure that no button on the device is pressed during startup.

Technical notification

Notification message	Description/Remedy
Defibrillator	
SHOCK CANCELLED	- If the capacitor is charging, no DC power and no energy is available from the battery, check battery and DC power → Replace the battery and check if battery is charging with DC power if not: → Get device repaired
ECG	
ECG amplifier failure	- Device is not able to configure the ECG amplifier → Get device repaired
Battery	
UPS Battery Defective	- Whenever the UPS-Charger fails to charge the UPS Battery → Device still operational except battery replacement without shutdown. Get device repaired as soon as possible.
Device	
- IGBT Test failed - Capacitor Test failed - Relay Test failed	- Test failed during RTU or manual selftest (see trouble shooting) → Get device repaired
Pacer	
Pacing stopped	- Device stops the pacing automatically when: → ECG cable is off, check electrodes → Defibrillator electrodes are off, check Defi electrodes) → When battery is empty or removed, check battery → Hardware failure DPM

6.8 Preventing electromagnetic interferences



The user can help avoid electromagnetic disturbances by keeping the minimum distance between portable and mobile **radio frequency** (RF) telecommunication devices (transmitters) and the **Tempus LS-Manual**. The minimum distance of 0.3 m has been tested according to IEC 60601-1-2 for a wide range of telecommunication equipment, as shown in the following table:

RF emission source of wireless communications devices	Transmitter frequency [MHz]	Testing frequency [MHz]	Max. power P [W]	Distance d [m]
Various radio services (TETRA 400)	380-390	385	1.8	0.3
- Walkie-talkies (FRS) - Rescue service, police, fire brigade, servicing (GMRS)	430-470	450	2	0.3
LTE band 13/17	704-787	710/745/780	0.2	0.3
- GSM800/900 - LTE band 5 - Radio telephone (microcellular) CT1+, CT2, CT3	800-960	810/870/930	2	0.3
- GSM1800/1900 - DECT (radio telephone) - LTE Band 1/3/4/25 - UMTS	1700-1990	1720/1845/1970	2	0.3
- Bluetooth, WLAN 802.11b/g/n - LTE Band 7 - RFID 2450 (active and passive transponders and reading devices)	2400-2570	2450	2	0.3
WLAN 802.11a/n	5100-5800	5240/5500/5785	0.2	0.3



WARNING

- ▲ **Portable RF** telecommunication devices must not be used within a radius of 0.3 m (1 ft) from the **Tempus LS-Manual** and its cables.
- ▲ Use of the **Tempus LS-Manual** adjacent to or stacked with other electric/electronic devices should be avoided - i.e. maintain a sufficient distance to other devices (this includes the patient cables).
- ▲ Observe the chapter [6.8.1 Measures to prevent electromagnetic interference](#).

For permanent RF telecommunication devices (e.g. radio and TV), the recommended distance can be calculated using the following formula: $d = 0.6 \times \sqrt{P}$. (The formula is based on the max. immunity level of 10 V/m in the frequency domain of 80 MHz to 3000 MHz).

- d = recommended minimum distance in meters
- P = transmitting power in Watts

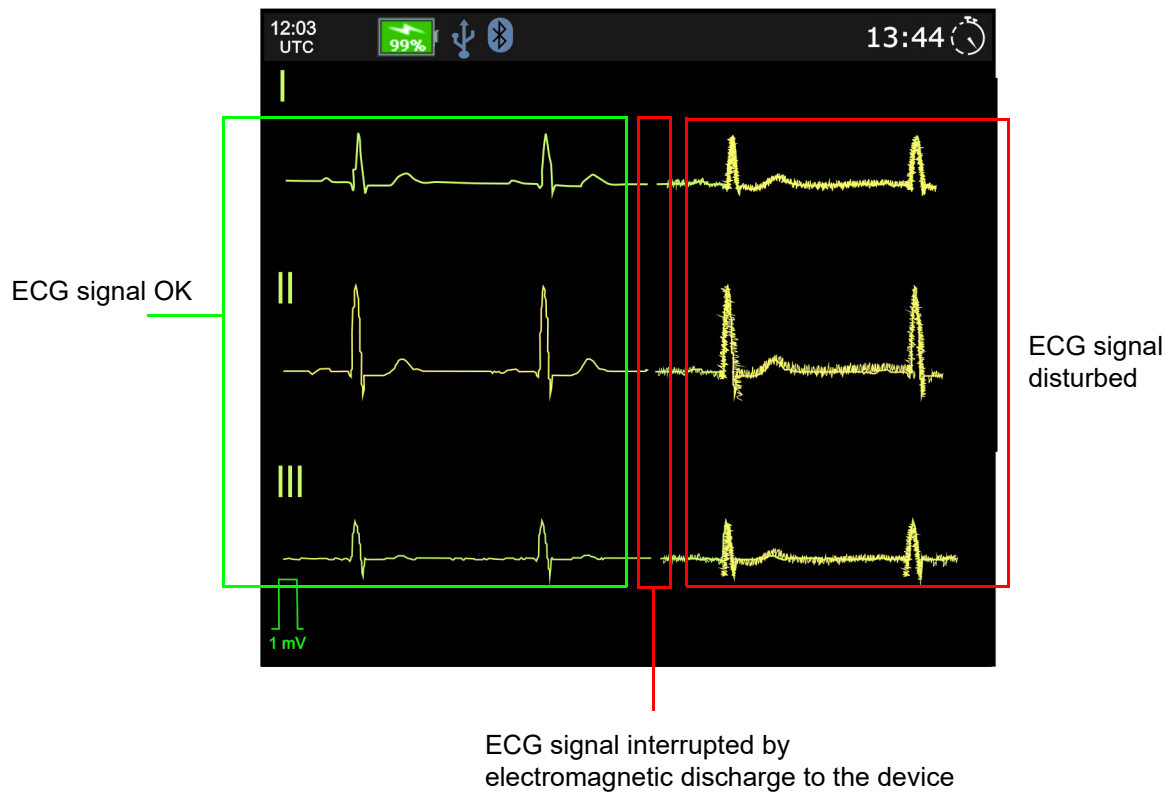


For more information on operation in an electromagnetic environment according to IEC/EN 60601-1-2, please consult RDT.

6.8.1 Measures to prevent electromagnetic interference

In the case of certain electromagnetic interference, artefacts can occur, which are distinguishable from the ECG signal. The essential performance characteristics of the device are not affected by these artefacts, but the user can take the following measures to prevent electromagnetic interference:

Typical disturbed ECG signal



The user can take the following measures to prevent electromagnetic interference:

- Increase distance to the source of interference.
- Turn off the source of interference.
- Turn the device to change the angle of radiation.
- Connect the device to a different mains connector.
- Only use original accessories (especially patient cables).
- Immediately replace defective cables, especially patient cables with defective sheathing.
- Make sure the patient cable is securely screwed on.
- Observe the maintenance intervals as stated in [6.1 Daily check and Maintenance interval](#).

6.9 Accessories and disposables



WARNING

- ▲ Always use RDT replacement parts and disposables, or products approved by RDT. Failure to do so may endanger essential performance, life and/or invalidate the warranty.



Always take spare batteries and pads before starting a shift.

6.9.1 Accessories Tempus LS-Manual

The following **Tempus LS-Manual** accessories and consumables are available from RDT:

Product name & description	Part number
General parts:	
Tempus LS-Manual - (00-3020)	Commercial - 989706001681 Service - 45356482181
Tempus LS-Manual Battery (till 2023)	01-3011
Tempus LS-Manual Battery (from 2023)	01-3030
Medical grade switching power supply, protection class I. • 100 - 240 VAC, max. 2.0 A, 50-60 Hz • 12 VDC, max. 4 A, 60 W	01-2049
Mains cable - US (earthed)	01-2055
Securing pads for CPR Sensor (5pk)	01-3022
Applied parts:	
Tempus LS-Manual Defibrillation/Pacing electrodes - Adult (1pk)	01-3020
Tempus LS-Manual Defibrillation/Pacing electrodes - Pediatric (1pk)	01-3021
Tempus Pro 3- lead ECG Cable (AAMI) 8 ft	01-2068
Tempus Pro 4- lead ECG Modular Trunk Cable (AAMI) 8 ft	01-2177
CPR Sensor	01-3023
Tempus LS Defib Simulator - (01-3015)	Commercial - 989706001141
Tempus LS DSD Simulator	Commercial - 989803220961

Chapter 7

Specification and standards

7.1 Physical characteristics and environmental specifications



Data refer to standard testing conditions.

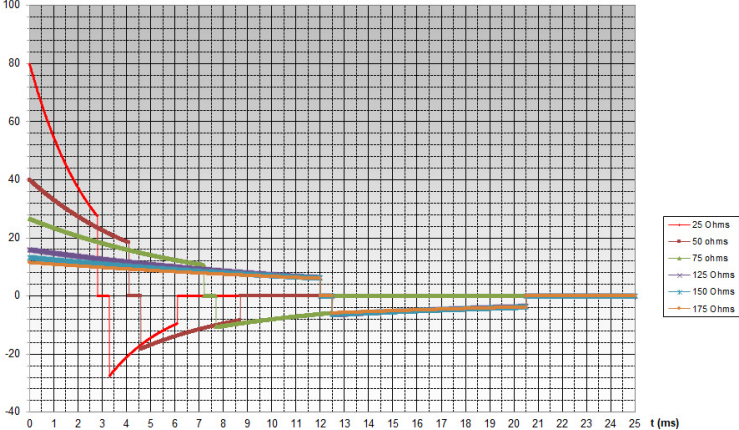
Device name	Tempus LS-Manual
Dimensions	200 x 164 x 72 mm (width x height x depth) With rear clip depth is 96 mm
Weight	1.95 kg with battery (without accessories)
Protection case	IP65 The device is protected against dust and water. Water projected from jets against the enclosure from any direction shall have no harmful effects.
Power supply AC/DC Input output	Type ASTEC Model: DPS53-M Medical grade switching power supply, protection class I. 100 - 240 VAC, max. 2.0 A, 50/60 Hz 12 VDC, max. 4 A, 60 W  The power supply's altitude rating of 4000m must be adhered to. Do not use the power supply outside of its specification. Do not use it outdoor or in ambulances, fixed and rotary wing aircraft)
Power battery Battery Autonomy Charging time	- Lithium/ion 10.8 V, 5.2 Ah, 56.2 Wh (type 01-3011) - Lithium/ion 10.8 V, 5.74 Ah, 62 Wh (type 01-3030) 300 shocks with maximum energy or >12 hour ECG display 90%: 3/3.5^a hours after full discharge and device switched off 100%: approx. 4/4.5^a hours after full discharge and device switched off a. Charging time for battery part number 01-3011/01-3030.
Hot swap battery Battery type	Ensures continued monitoring for approx. 2 minutes when replacing the power battery 2 x Li/ion polymer 3.7 V 0.33 A
Environmental conditions For operation For transient operation	-5 °C...50 °C relative humidity at 15 - 95% (non-condensing) Atmospheric pressure 540...1060 hPa (5000 m/16404 ft) between 610 and 540 hPa (4000 to 5000 m/ 13123 to 16404 ft) only without external AC/DC power supply -20 °C...50 °C according to IEC 60601-1-12

Environmental conditions For storage and transport between uses Time for warming up/cooling down	-20 °C...70 °C relative humidity at 0 - 95% (non-condensing) Atmospheric pressure 500...1200hPa > 60 minutes; Time required for the Tempus LS-Manual to warm or cool from the minimum/maximum storage temperature between uses until the Tempus LS-Manual is ready for its intended use when the ambient temperature is 20 °C
Environmental conditions Defibrillation electrodes Storage Storage max. 10 days	0 °C...50 °C -40 °C...75 °C
Display Type Dimensions	- LCD color with back-light, protected by tempered glass 116 x 87 mm
Signal sound level	>50/ >60/ >70 dBA (Low/Mid/High)
Connections	- Defibrillation -Pads - ECG - patient cable - DC power supply
Interfaces	- USB - Bluetooth
Memory	> 100 hours memory (FIFO) Recording of Defib, ECG Lead I, II, III, Impedance curves, Events, CPR feedback, patient data
EMC	- IEC/EN 60601-1-2: 2014, 4th Edition - IEC/EN 60601-2-4: 2010 EMC part §202 - IEC/EN 60601-2-27: 2011 EMC part §202 - CISPR 11: 2015; class B The device can be exposed to the following source of interference without impairment of the essential performance: - Static discharges up to 15 kV - Field strength up to: 3 V/m for ECG signal mode (80% AM at 1 kHz) 20 V/m in Defibrillation mode (5 Hz AM) 10 V/m for Pacemaker mode (5 Hz AM) for all in the radio frequency range of 80...2700 MHz - Magnetic fields of 100 A/m, 50/60 Hz

7.2 Standards

Conformity	CE according to directive 93/42/EEC class IIb
Defibrillator	IEC/EN 60601-2-4 The device is designed for intensive use
Electrical protection class	According IEC 60601-1: 2012, Electrical safety • The Tempus LS-Manual is internally (battery) powered. • Power supply is class I • Applied part type CF for ECG signal input • Applied part type BF for defibrillator input
Requirements for the basic safety and essential performance of electrocardiograph monitoring	IEC/EN 60601-2-27 (without alarm system)
Ingress protection	IP65 according IEC 60529
Environmental condition for emergency medical devices	IEC 60601-1-12
Environmental Conditions and Test Procedures for Airborne Equipment	RTCA DO-160G, 2010 section 21 cat. M and section 20 cat. R ISO 7137, June01, 1995, reference No. 3.7 MIL-STD 810G 514.5 cat. 9
EMC	• IEC/EN 60601-1-2: 2014, 4th Edition • IEC/EN 60601-2-4: 2010 EMC part §202 • IEC/EN 60601-2-27: 2011 EMC part §202 • CISPR 11: 2015; class B

7.3 Defibrillation

Waveform	• Biphasic truncated exponential waveform • Maintains the energy delivered (max. 200 Joules to the patient at an approximately constant level with regard to patient resistance). BTE 200J delivered on different impedances 																
Accuracy of delivered shock Energy measured @ selected 200 Joule for different patient impedances Rpat [Ω]	Deviation from the selected energy at 25 till 175 Rpat [Ω]: ± 3 J or ± 15% (the higher value is assumed) <table><tr><td>Rpat [Ω]</td><td>25</td><td>50</td><td>75</td><td>100</td><td>125</td><td>150</td><td>175</td></tr><tr><td>Energy [J] measured</td><td>205</td><td>199</td><td>197</td><td>193</td><td>195</td><td>188</td><td>180</td></tr></table>	Rpat [Ω]	25	50	75	100	125	150	175	Energy [J] measured	205	199	197	193	195	188	180
Rpat [Ω]	25	50	75	100	125	150	175										
Energy [J] measured	205	199	197	193	195	188	180										
Standard energy settings Manual mode – Adult – Pediatric	Deviation at 50Ω: ± 3 J or ± 15% (the higher value is assumed) • 1, 2, 3...to 10, 15, 20, 30, 50, 70, 90, 100, 120, 150, 170, 200 joules • 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 30, 50, 70, 90, 100 joules																
Charging time for shock in manual model with 12 VDC mains voltage with fully charged battery after 15 discharges with max. energy from switch-on of the device with pads	(Time used to charge the storage capacitor to the max. energy of 200 J in manual mode) 9 seconds 9 seconds 14 seconds																
Operating Modes	• synchronised with heart action < 60 ms after R wave • Non-synchronised																
Charge control and monitoring	• Display of selected energy																
Patient resistance	25...250 Ω (Impedance is compensated up to 200 Ω)																

Indication when ready to shock	LED  is lit
Shock delivery	Using key 
Safety discharge occurs when:	• the battery voltage is insufficient • the shock is not released within 20 seconds • the device is defective • the device is turned off • the disarm function key is pressed in manual mode
Shock delivery	Via applied disposable adhesive defibrillation electrodes
Defibrillation electrode connection	Type BF, defibrillation-protected >5 kV
Defibrillation electrodes Adult and Pediatric electrode	Electrode cable, 2 m (6.6 ft) long • 80 cm² active surface
Frequency range defibrillation ECG amplifier	1 - 25 Hz

7.4 Pacemaker

Operating Modes	• Demand • Fixed frequency
Stimulation pulse Form Pulse duration Pulse rate Pulse current Refractory period Signal connection Readiness for operation	• Rectangle mono-phase with constant current source • 20 ms $\pm$ 5% • Configurable in steps of 40, 45, 50, 60, 70...180 bpm $\pm$ 1.5% • Configurable to 0 (pacemaker Off) and then from 10...200 mA, $\pm$ 10% or 5 mA (the higher value is applied) • 340 ms $\leq$ 80 bpm • 240 ms $>$ 80 bpm • Type BF, defibrillation-protected $>$ 5 kV • Immediately
Pacer electrodes (same as defibrillation electrodes) Adult and Pediatric electrode duration	Electrode cable, 2 m (6.6 ft) long 80 cm ² active surface For up to 1 hour of pacing using 140mA / 120 bpm (pulse duration 20ms) For up to 8 hours of pacing using 70mA / 60 bpm (pulse duration 20ms) inspection of pads every 30 minutes

7.5 ECG signal display

Patient cable	3-lead and 4-lead (wire) cable, type CF
Heart rate	
Range	15 – 300 bpm
Accuracy	±10% or 5 bpm, whichever is greater
Lead display	Lead I, II, III and aVR, aVL, aVF selectable, additional leads selectable
Sensitivity	5, 10, 20 mm/mV programmable
Blockage caused by defibrillation shock	Max. 5 seconds according to IEC specifications 60601-2-27 Cl. 201.7.9.2.9.101 a) 4).
Input impedance	≥ 2.58 MΩ
Applied patient DC lead off current	< 0.5 μA applied to the patient according to IEC specifications 60601-2-27, 201.7.9.2.9.101 b)1)
Suppression of large T-waves	max. amplitude of T-wave according to IEC 60601-2-27 section 201.12.1.101.17: 0.8 mV
HR averaging method	The heart rate calculation is done using a user-defined number of previous RR intervals (minimum 4, maximum 16). The RR intervals are reset and the heart rate is set to zero whenever an asystole condition has been detected
Response time HR measurement	- Change from 80 to 120 beats per minute: 5 s - Change from 80 to 40 beats per minute: 8 s (according to IEC specifications 60601-2-27, 201.7.9.2.9.101 b5)
Reaction to an irregular rhythm	- A1: 80 bpm - A2: 60 bpm - A3: 124 bpm - A4: 94 till 121 bpm (except for triggers no. 6 and 7, HR < 90 bpm) (according to IEC specifications 60601-2-27, 201.7.9.2.9.101 b4)
ECG amplifier	
Bandwidth	0.05 to 150 Hz (-3 dB)
Sampling rate	1000 Hz
Pacemaker rejection	± 2 mV to ± 700 mV/0.1 till 2.0 ms without overshoot ± 2 mV to ± 700 mV/0.1 till 2.0 ms with overshoot < 20 ms
QRS detection range	Duration: 70 to 120 ms, amplitude: 0.5 to 5.0 mV
Protection	Fully isolated, defibrillation-protected >5 kV
Mains filter	Distortion-free suppression of superimposed 50 / 60 Hz sinusoidal interferences by means of adaptive digital filtering.
Frequency range ECG display	0.5 - 40 Hz ECG signal view (measurements has ST segment quality (CBS filter))

7.6 Electromagnetic interference

The **Tempus LS-Manual** is intended to be used in the electromagnetic environments listed in the following tables. The user of the **Tempus LS-Manual** must ensure that the device is used in a suitable environment.

7.6.1 Electromagnetic emissions

Emission measurement	Compliance with the regulations	Electromagnetic environment - explanations
HF emissions CISPR 11	Group 1	Tempus LS-Manual only uses HF energy for internal functions. Therefore, HF emissions are very low and interference with electronic devices nearby is unlikely. Tempus LS-Manual is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
HF emissions CISPR 11	Class B	
Harmonics IEC 61000-3-2	Class B	
Voltage fluctuations IEC 61000-3-3	Compliant	

7.6.2 Electromagnetic immunity

Interference testing	IEC 60601 test level	Conformity level	Electromagnetic environment - explanations
Electrostatic discharge IEC 61000-4-2	± 8 kV contact ± 15 kV air	IEC 60601-1 conformity	Floors should be made of wood, concrete or ceramic tiles. If floors are covered with synthetic material, relative humidity should be at least 30%. Note: In case of strong ESD discharges, artefacts can occur, which are clearly distinguishable from the ECG signal. The essential performance characteristics of the device are not affected by this.
Electrical fast transient/burst IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	IEC 60601-1 conformity	Mains power quality should be that of a typical commercial and/or hospital environment. Note: In the case of a strong fast transient / burst, artefacts can occur, which are clearly distinguishable from the ECG signal. The essential performance characteristics of the device are not affected by this.
Surge IEC 61000-4-5	± 1 kV between conductors ± 2 kV conductor-earth	IEC 60601-1 conformity	Mains power quality should be that of a typical commercial and/or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	0% nominal voltage during 0.5 period 40% nominal voltage during 100 ms at 50/60 Hz 70% nominal voltage during 500 ms at 50/60 Hz 0% nominal voltage during 5 s at 50/60 Hz	IEC 60601-1 conformity	Mains power quality should be that of a typical commercial and/or hospital environment. If the user of the Tempus LS-Manual is reliant on permanent operation even in the case of a power failure, it is suggested connecting the Tempus LS-Manual to an uninterruptible power supply or use it with a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	30 A/m	100 A/m	Power frequency magnetic fields should be that of a typical commercial and/or hospital environment.
Note: U_T indicates the AC voltage of the mains before the test level.			

Interference testing	IEC 60601 test level	Conformity level	Electromagnetic environment - explanations
			Recommended minimum distances Portable and mobile HF telecommunication devices must keep the recommended minimum distance from the Tempus LS-Manual and all its components, incl. cables; the recommended minimum distance is calculated based on the transmitter's frequency.
Conducted HF IEC 61000-4-6	3 V_{eff} between 150 kHz and 80 MHz outside of the ISM frequency bands^a 10 V_{eff} between 150 kHz and 80 MHz within the ISM frequency bands^a	3 V 10 V	$d = \frac{3,5}{3} \times \sqrt{P}$ $d = \frac{12}{10} \times \sqrt{P}$
Radiated HF IEC 61000-4-3	ECG: 3 V/m Defibrillator: 20 V/m Pacer: 10 V/m all from 80 MHz to 2.7 GHz	3 V/m 20 V/m 10 V/m 	ECG: $d = \frac{12}{3} \times \sqrt{P}$ between 80 MHz and 800 MHz $d = \frac{23}{3} \times \sqrt{P}$ between 800 MHz and 2.7 GHz Defibrillator: $d = \frac{12}{20} \times \sqrt{P}$ between 80 MHz and 800 MHz $d = \frac{23}{20} \times \sqrt{P}$ between 800 MHz and 2.7 GHz Pacer: $d = \frac{12}{10} \times \sqrt{P}$ between 80 MHz and 800 MHz $d = \frac{23}{10} \times \sqrt{P}$ between 800 MHz and 2.7GHz where P is the maximum transmitting power of the transmitter in Watt (W) according to manufacturer data, and d the recommended minimum distance in metres (m)^b. The field strength of stationary HF transmitters (according to an on-location measurement ^c) must not exceed the conformity level for each frequency range ^d. When operating the device near devices bearing the symbol "ionising radiation", interferences can occur.
Proximity fields from RF wireless communications equipment IEC 61000-4-3	see section 7.6.3	see section 7.6.3	see section 7.6.3

Interference testing	IEC 60601 test level	Conformity level	Electromagnetic environment - explanations
Note 1 For 80 MHz to 800 MHz, the higher frequency range applies. Note 2 These guidelines might not always be applicable. Electromagnetic radiation is influenced by absorption and reflection on structures, objects and people.			
- The ISM frequency bands (ISM = industrial, scientific, medical) between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz. - The conformity levels within the ISM frequency bands between 150 kHz and 80 MHz and between 80 MHz and 2.5 GHz serve to minimize the probability of interferences caused by mobile/portable communication equipment that accidentally happens to be in the patient environment. The formula for the calculation of the recommended distance has been adapted by the factor 10/3 for transmitters in this frequency range. - The field strength of stationary transmitters, e.g. base stations for radio telephones (mobile or cordless) and portable radio equipment, amateur radios, AM and FM radios and TV signals cannot be predicted accurately in a theoretical way. In order to analyse electromagnetic environments caused by stationary HF transmitters, an electromagnetic analysis on site should be considered. If the measured field strength exceeds the HF conformity level, it needs to be checked whether the Tempus LS-Manual can be used in this environment. If an abnormal behaviour is detected, additional measures need to be taken, e.g. reorientation or change of location of the Tempus LS-Manual. - For the frequency range between 150 kHz and 80 MHz, the field strength must be lower than 3 V/m.			

7.6.3 Immunity to proximity fields from RF wireless communications equipment

Test frequency [MHz]	Band ¹ [MHz]	Service	Modulation	max. power P [W]	Distance [m]	Immunity level [V/m]
385	380-390	Various transmitting services (TETRA 400)	Pulse modulation ² 18 Hz	1.8	0.3	27
450	430-470	- Walkie-talkie (FRS) - Rescue, Police Fire brigade, Maintenance (GMRS)	FM ³ ±5 KHz ±1 KHz sine	2	0.3	28
710 745 780	704-787	L TE Band 13/17	Pulse modulation 217 Hz	0.2	0.3	9
810 870 930	800-960	- GSM800/900 - LTE band 5 - Mobile phone CT1+, CT2,CT3	Pulse modulation 18 Hz	2	0.3	28
1720 1845 1970	1700-1990	- GSM1800/1900 - DECT (mobile phone) - LTE Band 1/3/4/25 - UMTS	Pulse modulation 217 Hz	2	0.3	28
2450	2400-2570	- Bluetooth, WLAN 802.11b/g/n - LTE Band 7 - RFID 2450 (active and passive Transponder and reader)	Pulse modulation 217 Hz	2	0.3	28
5240 5500 5785	5100-5800	WLAN 802.11a/n	Pulse modulation 217 Hz	0.2	0.3	9

1. For some services, only the uplink frequencies are included.

2. The carrier shall be modulated using a 50% duty cycle square wave signal.

3. As an alternative to FM modulation, 50% pulse modulation at 18 Hz may be used because while it does not represent actual modulation, it would be worst case

7.6.4 Recommended separation distances

For fixed installed HF-Transmitters (z.B Radio und TV transmitters) the following minimum distance to the transmitter can be calculated as follows:

Max. transmitting power of the transmitter (W)	Distances according to the transmitter's frequency (m)			
			Defibrillation mode	
	$d = \frac{3.5}{3} \times \sqrt{P}$ between 150 kHz and 80 MHz outside of the ISM frequency band	$d = \frac{12}{20} \times \sqrt{P}$ between 150 kHz and 80 MHz within the ISM frequency band	$d = \frac{12}{20} \times \sqrt{P}$ between 80 MHz and 800 MHz	$d = \frac{23}{20} \times \sqrt{P}$ between 800 MHz and 2.7 GHz
0.01	0.12	0.06	0.06	0.12
0.1	0.37	0.19	0.19	0.38
1	1.17	0.6	0.6	1.8
10	3.69	1.895	1.895	3.64
100	11.67	6	6	11.5
	Pacer mode		ECG display mode	
	$d = \frac{12}{10} \times \sqrt{P}$ between 80 MHz and 800 MHz	$d = \frac{23}{10} \times \sqrt{P}$ between 800 MHz and 2.7 GHz	$d = \frac{12}{3} \times \sqrt{P}$ between 80 MHz and 800 MHz	$d = \frac{23}{3} \times \sqrt{P}$ between 800 MHz and 2.7 GHz
0.01	0.12	0.23	0.4	0.77
0.1	0.38	0.72	1.3	2.4
1	1.2	2.3	4	7.7
10	3.8	7.27	13	24
100	12	23	40	77

For transmitters with a max. transmitting power that is not listed in the above table, the recommended minimum distance d in meters (m) can be calculated using a formula based on the transmitter's frequency, where P is the max. transmitting power of the transmitter in Watts (W) (according to manufacturer data).

Note 1 These guidelines might not always be applicable. Electromagnetic radiation is influenced by absorption and reflection on structures, objects and people.

Note 2 To calculate the recommended minimum distance of transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency band between 80 MHz and 2.5 GHz, the additional factor 10/3 is used to minimize the probability of interferences caused by mobile/portable communication equipment that accidentally happens to be in the patient environment.

7.7 Bluetooth standard

Module	PAN1026
FCC ID IC ID	T7VPAN10 216Q-PAN10
Transmission standards	Bluetooth version 4.0 LE
Frequency range	2402...2480 MHz
Max. power output Class 2	+4 dBm (max. transmitting distance approx. 10 m)

7.8 CPR Sensor

Sensor name	CPR Sensor
Dimensions	80 x 25 mm (diameter/ depth)
Weight	152 g
Cable length	2 m
Power supply	5 VDC via USB from the medical device
Environmental conditions Operation Transport Storage For Transport and storage between uses	-5 °C...50 °C relative humidity at 15 - 95% (non condensing) -10...50°C / +5...50°C, humidity 10...95% (non condensing), pressure 500...1060 hPa. -40...75 °C, relative humidity of 10...95% (non-condensing) Atmospheric pressure 500...1060 hPa (5000m to -400m) for above
Measured values Frequency Compression depth	1 to 160 compression/min (cpm) 1 to 127 mm
Accuracy	± 3 compressions/min ± 5% at 50 mm (laboratory condition)
Life cycle	500'000 compressions
Dust and water protection	IP66
Protection class	Type BF defibrillation proof

Chapter 8

Pairing with Tempus Pro

This chapter explains using the **Tempus Pro** with the **Tempus LS-Manual**.

When the TDL link is on, **Tempus LS-Manual** automatically transmits event data to **Tempus Pro**, which records these events in its summary record of care. **Tempus Pro** can print these events manually (when requested by the user) or automatically (on units with an internal printer).

The TDL link may be wireless (via Bluetooth) or direct (via USB data cable).



Important

If the software versions of the **Tempus LS-Manual** and **Tempus Pro** are found to be incompatible on connection, the following dialog will be displayed by the **Tempus Pro**:

"Attention - **Tempus Pro** Connection Unable to connect to the **Tempus LS-Manual**

This could be because the software versions on the **Tempus Pro** and **Tempus LS-Manual** are incompatible.

Ensure the **Tempus Pro** and **Tempus LS-Manual** are both updated with the latest software."

I If this message appears, contact "RDT_Techsupport@philips.com" to obtain the latest software versions.

I If the software versions of the **Tempus Pro** and **Tempus LS-Manual** are incompatible, the Pro and LS manual will pair via the TDL Link as normal, however, no event data will be automatically transmitted from the LS to the Pro via the TDL link. The event data will continue to be stored on the LS as normal and can be exported using the Export feature in the LS device



WARNING

Connecting a patient to two ECG leads from two devices (e.g. **Tempus LS-Manual** and **Tempus Pro**), may cause electrical noise or interference that will affect the quality of ECG recordings. The ECG waveform may be distorted or unreadable.

8.1 Pairing Tempus Pro with Tempus LS-Manual



- Device authentication is required for wireless TDL link operation between **Tempus Pro** and **Tempus LS-Manual**; authentication setup is described in the **Tempus Pro** Maintenance Manual.
- To allow the TDL link to operate wirelessly, the **Tempus Pro** and **Tempus LS-Manual** must be paired via Bluetooth and via USB cable for the first time to exchange the authentication. This pairing is normally performed once only, the first time the two devices are used together. Pairing is normally retained after this.
- The **Tempus LS-Manual** device remains discoverable for only 30 seconds after the user attempts to pair with the Menu button , otherwise the device will be undiscoverable.

- If **Tempus Pro** and **Tempus LS-Manual** are both currently unpaired, you can pair them via either Bluetooth or a USB data cable.
- When connected via USB data cable, the devices silently pair via Bluetooth, meaning that when they are no longer connected via USB data cable they remain paired via Bluetooth.
- The **Tempus Pro** Maintenance Manual describes how to configure **Tempus Pro** to not persist Bluetooth pairing with **Tempus LS-Manual** after powering off. If persist **Tempus LS-Manual** pairing is switched off, you will need to repeat Bluetooth pairing every time **Tempus Pro** is powered on.
- The **Tempus Pro** Maintenance Manual describes how to configure **Tempus Pro** to exchange the authentication with the maintenance password of the **Tempus LS-Manual**.
 1. Put **Tempus Pro** and **Tempus LS-Manual** within 5 meters of each other (preferably in line of sight).
 2. On the **Tempus Pro**, press and hold Main  for at least 2 seconds until the Bluetooth icon  starts to blink (alternatively, select Main Menu > TDL Settings > Connect to a **Tempus LS-Manual**).
 3. On the **Tempus LS-Manual**, press and hold the Menu button  for at least 2 seconds until the Bluetooth icon  starts to blink.
 4. After 15 seconds (typical), the units pair and sound the link audio tones and flash their LEDs. The 'TDL' icon appears in the **Tempus Pro** status bar:



Event data created on the **Tempus LS-Manual** will now be pushed to the **Tempus Pro** and incorporated into the Summary Record of Care.

8.2 Using the TDL link



- The **Tempus LS-Manual** and **Pro** device pair must be provisioned for pairing and authentication prior to attempting the TDL connection (see section [8.1 Pairing Tempus Pro with Tempus LS-Manual](#)). If you are unable to successfully pair your devices, contact your fleet administrator or "RDT_Techsupport@philips.com".

Connecting via Bluetooth

If Bluetooth pairing has been completed and if **Tempus Pro** is configured to persist pairing, the TDL link is active as soon as **Tempus Pro** and **Tempus LS-Manual** are powered on.

Connecting via USB cable

Tempus Pro and **Tempus LS-Manual** can also be connected via USB data cable (with or without Bluetooth). To set up the TDL link via USB data cable, use either a direct or an indirect connection:

- Direct connection - plug a USB data cable into the USB ports of **Tempus Pro** and **Tempus LS-Manual**.
- Indirect connection - plug a USB data cable into the USB ports of the Smart Mounts of **Tempus Pro** and **Tempus LS-Manual**, then dock the two units in their Smart Mounts.

If Bluetooth is enabled on the **Tempus Pro**, it silently pairs with the **Tempus LS-Manual** when the devices are connected via USB data cable. After 15 seconds (typical), the units pair and sound the link audio tones and flash their LEDs. The 'TDL' icon appears in the **Tempus Pro** status bar:



Identifying the connected Tempus LS-Manual

On the **Tempus Pro**, select [Main](#)  > [TDL Settings](#) > [Identify connected Tempus LS](#). This triggers TDL link audio tones and LEDs on the connected **Tempus LS-Manual**.

8.3 Using the connected units on different patients



WARNING

To avoid mixing up patients, always discharge and admit when moving between patients.

If you need to use the connected Tempus Pro and Tempus LS-Manual on different patients:

1. On the Tempus Pro, select **Main**  > **TDL Settings**.
2. Set **TDL Link** to **off**.
3. When the confirmation dialog is displayed, press **Confirm**. Data from the current Tempus LS-Manual patient will not be written to the Tempus Pro summary record of care.
4. Press **Back**.



When TDL Link is off, Tempus Pro and Tempus LS-Manual remain connected.

To revert to using the connected Tempus Pro and Tempus LS-Manual on the same patient:

1. On the Tempus Pro, select **Main**  > **TDL Settings**.
2. Set **TDL Link** to **on**.
3. When a dialog is displayed with the question "Are the Tempus Pro and Tempus LS-Manual being used on the same patient?", press **Yes - same patient**. Data from the current Tempus LS-Manual patient will be written to the Tempus Pro summary record of care.
4. Press **Back**.

Certain events will cause Tempus Pro to display the question "Are the Tempus Pro and Tempus LS-Manual being used on the same patient? In response, select one of two options:

- **Yes - same patient** - data from the Tempus LS-Manual will be written to the Tempus Pro summary record of care.
- **No - different patient** - data from the Tempus LS-Manual will not be written to the Tempus Pro summary record of care.

8.4 Tempus LS-Manual event capture

If **Tempus Pro** is connected with a **Tempus LS-Manual** defibrillator and the TDL link is on, defibrillator events are recorded in the summary record of care (SRoC).



CAUTION

Data from the **Tempus LS-Manual** will only be available if the connected **Tempus Pro** and **Tempus LS-Manual** are linked (that is, TDL Link is on) and sufficient time has been given for the data to transfer. When linked, a statement at the top of the SRoC screen will indicate if synchronization of data is in progress or incomplete. If the TDL link is not active, no **Tempus LS-Manual** data will be merged into the patient SRoC. The progress of data transfer does not affect the normal operation of the **Tempus LS-Manual** or **Tempus Pro**.



Important

The CPR start, stop and rate recorded in SRoC when the CPR Sensor is not used is based on impedance measurements and therefore the rate is guidance only. For an accurate rate measurement use the CPR Sensor.

The SRoC Summary tab displays the 'LS' icon against events captured from the **Tempus LS-Manual**, as shown in this example:



Tempus LS-Manual events captured in the SRoC include:

- Pads attached/detected and detached
- Shock delivered
- Pacer events
- Mode switching
- CPR events
- Waveform capture – this is triggered by pressing the **Snapshot / Print** button on **Tempus LS-Manual**. The waveform capture is depending of the selected screen.

- CPR events - the average speed of CPR compressions; if a CPR Sensor is used, the percentage of good compressions is also captured.
- ECG lead traces (leads I, II, III, PADS acquired by either the ECG cable or electrode pads).
- Heart rate
- Self test results

Default settings on **Tempus LS-Manual** can be configured to automatically print waveforms for certain of these even.



Copyright © 2024
Koninklijke Philips N.V.

This document contains legally protected information. All rights reserved. Copying in mechanical, electronic and any other form without the written approval of the manufacturer is prohibited.

Remote Diagnostic Technologies Ltd.
Ascent 1,
Farnborough Aerospace Centre
Aerospace Boulevard
Farnborough
Hampshire
GU14 6XW
UK

Tel +44 (0) 1256 362 400
www.philips.com

Date of issue: 2024-10-14

Part number: 41-3007EN-04