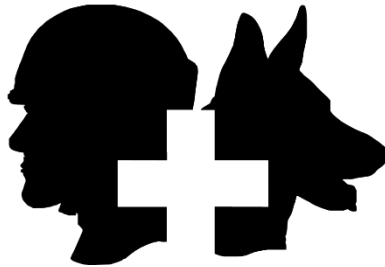


TRAUMA F/X[®]

Improving Survivability



TRAUMAFX[®] VITAL SIGNS MONITOR (VSM)

TraumaFX[®] Vital Signs Monitor (VSM) User Guide

Rev_Q42019

TRAUMA F/X[®]

Improving Survivability

TraumaFX® Vital Signs Monitor (VSM)

TraumaFX Customer Service

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1-800-200-7465

TABLE OF CONTENTS

Chapter 1: Introduction.....	1
About the TraumaFX® Vital Signs Monitor	1
Compatible TraumaFX® Upper Units	1
Item Checklist	1
Standard Components and Accessories	1
System Overview.....	2
Special Notes and Cautions.....	2
Water Resistance and Cleanup.....	2
Wireless Control	2
Third Party User Manuals	2
Compliance	3
Chapter 2: Vital Signs Monitor (VSM) Features	4
Cautions and Care.....	4
Chapter 3: Getting Started.....	5
Notes on General Use and Care	5
Charging the Batteries.....	5
VSM Batteries	5
General Use and Care of Batteries.....	6
Installing and Removing the Battery.....	7
Installing and Removing the VSM Battery	7
Installing the Surface Go	7
Protecting the Surface Go Screen	8
Using HDMI Output	8
Using the VSM Without the Protective Case	8
Chapter 4: Operating the TraumaFX® Vital Signs Monitor (VSM)	9
Power	9
Pairing/Syncing a VSM	9
Power	10
Screen Layout.....	11
Main Menu Options.....	11
Additional Settings Screens	12
Alarm Settings	12
Vital Selection.....	13
Serial Settings	14
Running the App	14
Waveforms	14
Vitals	15

TABLE OF CONTENTS

Alarms.....	16
ECG Waveforms.....	17
Shock Waveform	19
Synchronized Cardioversion	20
Pacing Spikes	20
Pacing Capture	20
Packing	20
Chapter 5: After Use Care	21
Chapter 6: Troubleshooting	22
Additional Support.....	22
Customer Service and Support.....	22
Appendix A – Vital Signs Monitor Technical Specifications.....	23
Vital Signs Monitor	23
Makita DC18RC Battery Charger	24

Chapter

1

Chapter 1: Introduction

About the TraumaFX® Vital Signs Monitor

The TraumaFX® Vital Signs Monitor (VSM) is a stand-alone accessory for use with all powered TraumaFX® upper units. The familiar layout allows trainers and students to visualize simulated vital signs during TraumaFX simulations.

Compatible TraumaFX® Upper Units

- AirwayPlus Lifecast – Pulses/Breathing (APL-PB)
- Clinical Response Upper (CRU)
- Clinical Response Upper – Resuscitate (CRU-R)
- Emergency Medical Trauma Trainer – Tactical Medical Upper (EMITT-TMU)

The VSM is designed for rugged use in realistic training environments, however is not impermeable to damage. To ensure proper operation, do not subject the VSM unit to unnecessarily harsh treatment. Careful preventive maintenance and frequent after-use inspection is essential to ensure the service life of your Vital Signs Monitor. Please review **Chapter 5: After Use Care** which outlines the standard preventive maintenance required under the terms of the TraumaFX® limited warranty.



Item Checklist

The components listed below are required to set up and operate your TraumaFX® Vitals Monitor.

Standard Components and Accessories

Accessory Name	Order Number
18v Makita Battery	TFX-LO-BT-1
Vital Signs Monitor	TFX-VSM-1

Figure 1

System Overview



Figure 2

Special Notes and Cautions

Read all TraumaFX® instructional manuals before attempting to assemble, install, or operate any TraumaFX® product.

Water Resistance and Cleanup



DO NOT USE PRESSURIZED WATER OR SUBMERGE THE VSM UNDER WATER. REMOVE BATTERIES BEFORE CLEAN UP TO AVOID ELECTRIC SHOCK!

The VSM is water resistant, but is not waterproof. Carefully wipe the VSM case with a soft, damp cloth or sponge after each use, and use a screen-cleaning wipe to clean the monitor itself.



Wireless Control

The VSM system has an extended range, measured from the VSM to the Remote Control Transmitter (see technical specifications) and can be used indoors or outdoors. Note that indoor range is subject to building design and construction materials. Test system operations whenever setting up in a new location or moving to a different area of a building.



Third Party User Manuals

The VSM uses third-party commercially available equipment. Where such equipment is provided, the associated user manuals and any pertinent documentation are provided as well.



Compliance

If the VSM is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Chapter 2: Vital Signs Monitor (VSM) Features

This section describes the features of the VSM that contribute to the unique training experience that TraumaFX® simulators provide:

- Pairs wirelessly to TraumaFX Remote Control Transmitter
- Touch-screen surface – utilizes a Microsoft Surface Go
- Display shows waveforms for ECG, SpO2, and CO2
- Values are shown for Heart Rate, Blood Pressure, Oxygen Saturation, Respiration Rate, and End-Tidal CO2
- Values can be selected to show changes over time
- Alarms can be set by user for high/low values, and can be muted
- Touchscreen selection for patient cables in use
- Durable, protective case can sit flat on table or hang from bed rail
- Battery backup for extended power when away from AC
- HDMI output for classroom use

Cautions and Care

The VSM unit is water resistant, but not water proof. Avoid direct water contact with the monitor and battery compartment.

Chapter 3: Getting Started



Read all TraumaFX® manuals before attempting to assemble, install, or operate any TraumaFX® products or accessories.

Notes on General Use and Care

The TraumaFX® Vital Signs Monitor (VSM) is designed for rugged use in realistic training environments. Careful preventive maintenance and frequent after-use inspection is essential to ensure the service life. Please review **Chapter 5: After Use Care**, which outlines the after use care required under the terms of the TraumaFX® limited warranty.

Charging the Batteries



VSM Batteries

Read all instructions provided in the Operating Manual – Makita Battery Charger before using.

Each VSM utilizes has an internal rechargeable Lithium-Ion battery, and an 18v Makita Lithium-Ion battery for to extend the battery life. Additional batteries are available for purchase through TraumaFX by contacting your account representative or customer support.

Only use the batteries and charger(s) provided by TraumaFX; use of different equipment may result in damage to the batteries and/or TraumaFX equipment and will void the limited warranty. Read the instructions for the Makita battery and charger in the *Operating Manual – Makita Battery Charger* provided.

The Makita battery is a consumable item (with a one (1) year manufacturer's warranty); as with most batteries, Makita batteries have a finite shelf life. After considerable use, a "used" battery's voltage will drop to a point that it will no longer be able to hold a charge.

Recharging Internal Surface Go Battery

The internal battery for the Surface Go can be charged in one of two ways:

1. To use AC power, plug the AC battery charger provided with the Surface Go into a standard outlet and connect the custom connector to the side of the Surface.
2. To charge using the Makita battery, ensure the Surface Go is placed within the protective case. Attach a charged 18V Makita battery to the back of the case. Locate the power connection cable coming from the right side of the case and attach to the right side of the Surface Go.

Recharging VSM Makita Battery

1. **Plug** the Makita quick charger (Figure 3) into a standard 110V wall outlet.
2. **Slide** the battery onto the quick charger until firmly in place and the indicator light illuminates (each battery takes approximately 30-45 minutes to charge, and depending on the amount of usage, provides a full day of training support).
3. **Remove** the battery when readout indicates charging is complete.



Figure 3

NOTE: A 220V Makita charger is available for International use. This is a special-order item and available for purchase through TraumaFX by contacting customer support or your account representative.

General Use and Care of Batteries

All batteries used in TraumaFX products were specially selected to provide optimal operational performance. However, as with all batteries, they will last longer with proper care and maintenance. To preserve the life of the batteries, the following best practices are recommended:

1. Only use the batteries and charger(s) provided by TraumaFX; use of different equipment may result in damage to the batteries and/or the TraumaFX unit(s).
2. Remove battery from the VSM at the end of each training session. Batteries should never be stored attached to the VSM.

3. Recharge batteries immediately after use by placing them in the Makita battery charger.
4. Fully recharge all batteries before each training exercise. This is indicated by a solid green light on the charger for each battery.
5. Store batteries indoors, away from extreme temperatures (not above 120°F or below 38°F).
6. Only charge TraumaFX-related batteries using the approved chargers supplied with the TraumaFX system.

Installing and Removing the Battery

Installing and Removing the VSM Battery

1. **Install** the battery by inserting the battery into the back of the unit (Figure 4) by sliding the battery into the battery slot until it locks into place.
2. **Remove** the battery by pressing the white, push button located on the battery to remove the battery from the remote control transmitter.



Figure 4

Installing the Surface Go

1. **Slide** the Surface Go into the protective case, keeping the USB connection on the right and the on/off and volume control buttons on the top. It will click into place when fully installed.
2. **Connect** the USB-C cable coming from the right side of the case to the USB-C port on the Surface Go (Figure 5).
3. **Connect** the power cable coming from the right side of the case to the power port on the Surface Go.
4. **Remove** the Surface Go by pressing the button on the back of the upper left corner of the case; the surface can then slide out.



Figure 5

Protecting the Surface Go Screen

The screen of the Surface Go can be further protected from scratches and damage using any commercially-available screen protector sized for the Surface Go.

Using HDMI Output

The VSM can be connected to an external screen via HDMI; the image on the VSM is duplicated on the external screen. To connect to HDMI, unplug the USB-C connector from the Surface Go, and plug the provided HDMI dongle (Figure 6) into the USB-C port on the Surface Go in its place (Figure 7). Using the RC Transmitter, pair to the VSM once again, and connect the HDMI port on the dongle to the HDMI port on your external screen.



Figure 6

Using the VSM Without the Protective Case

The custom case for the VSM is designed to make the VSM easier to use, increase the battery life, and to provide protection from accidental damage to the Surface Go. Should you prefer to use the VSM without the protective case, plug the provided HDMI dongle into the USB-C port on the Surface Go, and pair to the VSM using the RC Transmitter. To extend the battery life outside of the protective case, the Surface Go can be plugged directly into an AC outlet using the power cord supplied with the Surface Go.



Figure 7

Chapter 4: Operating the TraumaFX® Vital Signs Monitor (VSM)

This chapter describes the operational features of the VSM.

Power

Power for the VSM is provided by an internal Lithium-Ion battery, and one (1) 18v (3.0-5.0Ah) Makita Lithium-Ion battery. All batteries are fully rechargeable and come with a charger and manufacturer's instructions and operating manuals. Turn the VSM power on by pressing the power button located at the top left of the Surface Go and follow the login prompts.

Pairing/Syncing a VSM

Should a VSM unit stop communicating with the Remote Control (RC) Transmitter, please sync the unit by performing the following steps:

1. Power on the Remote
2. Power on the TraumaFX® VSM
3. Press **Settings** from the Session Control Screen to get to the main splash screen.
4. From the main splash screen, press **Settings**
5. Press **Remote Settings**
6. Press **Scan for Accessories** (**Note:** Use the buttons available on the remote to scan and pair and the joystick to adjust your selection.)
7. Using the joystick on the remote, navigate up or down to the desired VSM unit and press **Pair with Selected**
8. Press **Next** to navigate to the Exit Settings Screen
9. Press **Exit** to return the main splash screen

Once paired, that RC Transmitter will remain paired to that VSM even after powering off the units. The paired VSM will show on the RC Transmitter Settings screen as shown in Figure 8.



Figure 8

Power

After verifying that the VSM is powered on and paired to the RC Transmitter, click the shortcut icon on the desktop to launch the Vital Signs Monitor app (Figure 9).



Figure 9

You should now see the Vital Signs Monitor *Main Screen*.

Screen Layout

The VSM *Main Screen* has the following features (Figure 10).

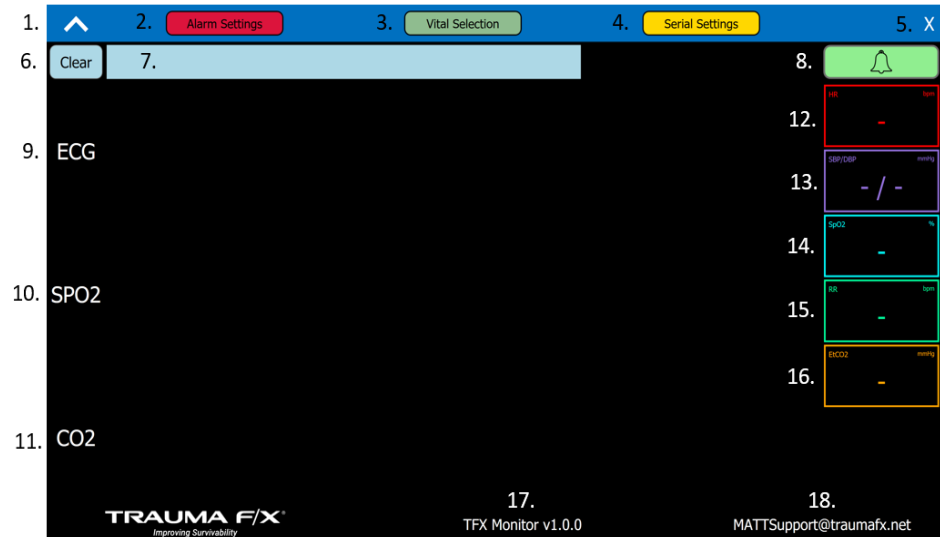


Figure 10

- | | |
|----------------------------------|-----------------------------|
| 1. Show/Hide Main Menu Arrow | 8. Silence Alarm Button |
| 2. Alarm Settings Window Button | 9. ECG Waveform |
| 3. Vital Selection Window Button | 10. SPO2 Waveform |
| 4. Serial Settings Window Button | 11. CO2 Waveform |
| 5. Close Button | 12. Heart Rate |
| 6. Clear Alarm Message Button | 13. Blood Pressure |
| 7. Alarm Message Box | 14. Oxygen Saturation |
| | 15. Respiration Rate |
| | 16. End-Tidal CO2 |
| | 17. Software Version |
| | 18. Customer Support E-mail |

Main Menu Options

Click on the Show Menu Arrow to open the Main Menu. The Main Menu contains buttons to open the additional settings pop-up windows (Figure 11).



Figure 11

1. Hide Main Menu Arrow: Hides the main menu
2. Alarm Settings Button: Opens a window to set the alarm thresholds for each vital
3. Vital Selection Button: Opens a window to select which vitals/waveforms should be displayed on the monitor
4. Serial Settings Button: Opens a window with various XBee connection information
5. Close Button: Closes the application

Additional Settings Screens

Alarm Settings

The Vitals Monitor has one alarm that sounds if any of the vitals are below a lower threshold or above a higher threshold. The Alarm Settings screen allows the user to set the two alarm thresholds for each vital (Figure 12). The Save button must be pressed to save the alarm setting changes.

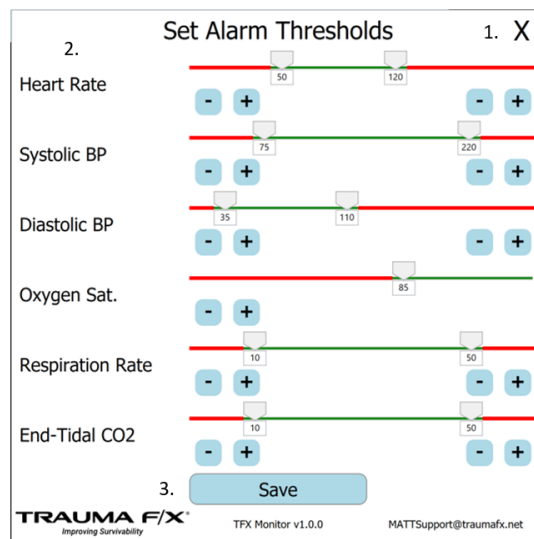


Figure 12

1. Close button: Exits the screen without saving the changes.

2. Sliders: One for each vital. Has a separate slider thumb to set the lower and higher thresholds.
3. Save button: Saves the settings as the new alarm thresholds and exits the screen.
4. Lower Threshold: Slider to set the lower limit. If the vital is below this limit, the alarm will sound.
5. Upper Threshold: Slider to set the upper limit. If the vital is above this limit, the alarm will sound.
6. Lower Threshold Text Box: Current lower limit. Touching the text box will bring up a touch keyboard that will allow the user to explicitly set the lower limit.
7. Upper Threshold Text Box: Current upper limit. Touching the text box will bring up a touch keyboard that will allow the user to explicitly set the upper limit.
8. Lower Threshold Increment/Decrement buttons: Buttons to increase or decrease the lower limit by 1 point.
9. Upper Threshold Increment/Decrement buttons: Buttons to increase or decrease the upper limit by 1 point.

Vital Selection

By default, no waveforms or vitals are displayed on the monitor when the session starts. You must manually select which waveforms/vitals to display either through the Monitor Leads screen on the RC Transmitter or through the Vital Selection screen on the monitor.

On the Vital Selection screen (Figure 13) simply check the waveform or vital to display it. For example, this screen is currently set up to display the ECG and SPO2 waveform and the heart rate, blood pressure, oxygen saturation, and respiration rate. The CO2 waveform and end-tidal CO2 will be disconnected.

Vital Selection		X
<input checked="" type="checkbox"/> ECG Waveform	<input checked="" type="checkbox"/> Heart Rate	
<input type="checkbox"/> CO2 Waveform	<input checked="" type="checkbox"/> Blood Pressure	
<input checked="" type="checkbox"/> SpO2 Waveform	<input checked="" type="checkbox"/> Oxygen Sat.	
	<input checked="" type="checkbox"/> Resp. Rate	
	<input type="checkbox"/> End-Tidal CO2	

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Figure 13

Serial Settings

The Serial Settings screen displays information about the XBee connection (Figure 14); this refers to the wireless connection between the VSM and the RC Controller. If the Vitals Monitor software has successfully found its own XBee then it will display its XBee name. This is the name of the XBee accessory you should pair with on the Remote.

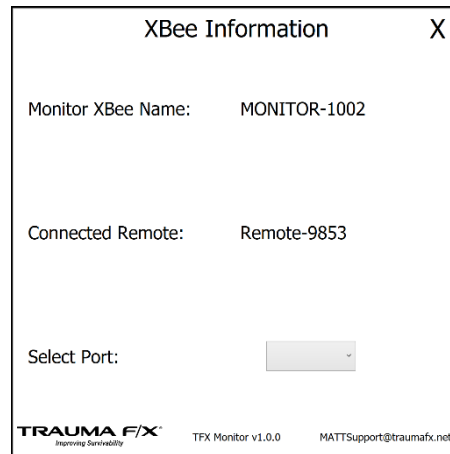


Figure 14

If the Vitals Monitor has successfully paired with a remote, then it will display the name of the remote it is connected to on this screen.

If there are connection issues, you can try to manually select which serial port the Vitals Monitor should use to look for its XBee. Click the “Select Port” drop down and select the XBee serial port. If no serial port appears, check your XBee USB connection and the USB hub/adaptor.

Running the App

After pairing with the monitor, start a session on the remote. By default, no waveforms or vitals are displayed, so the waveforms will just display a flat line and the vitals boxes will just contain a dash. Use the Vital Selection screen on the monitor or the Monitor Leads screen on the remote (ABCs -> Vitals -> Monitor Leads) to turn on the waveforms/vitals as the student applies the correct leads.

Waveforms

The monitor can display an ECG, SPO2, and CO2 waveform (Figure 15). The ECG and SPO2 strips are 6 seconds long and are based on the heart rate. The CO2 waveform is 12 seconds long and is based on the respiration rate and End-tidal CO2. A heartbeat sound will play as each R wave is displayed.

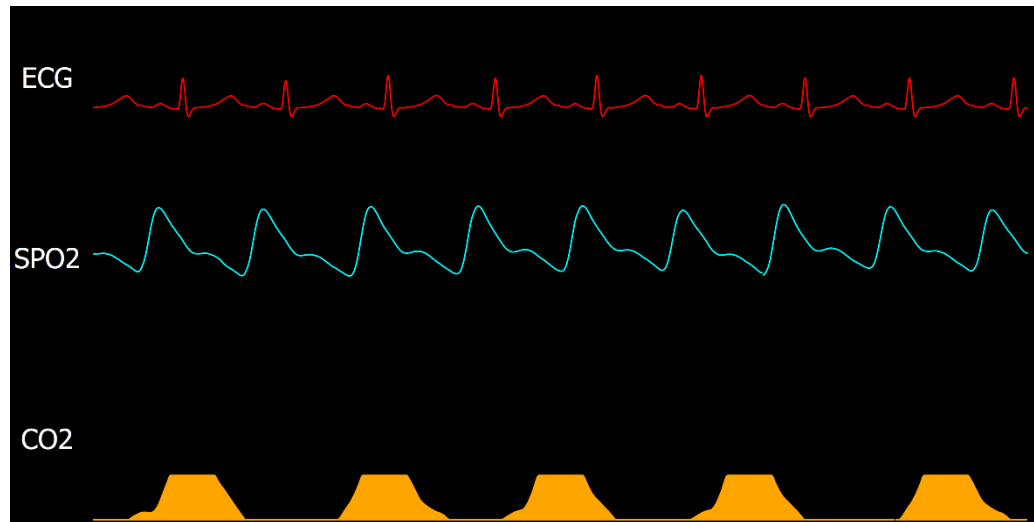


Figure 15

Vitals

The vitals are displayed in boxes on the right side of the screen (Figure 16). The Vitals monitor can display the heart rate (beats per minute), systolic and diastolic blood pressure (mmHg), oxygen saturation (percent), respiration rate (breaths per minute), and end-tidal CO₂ (mmHg).

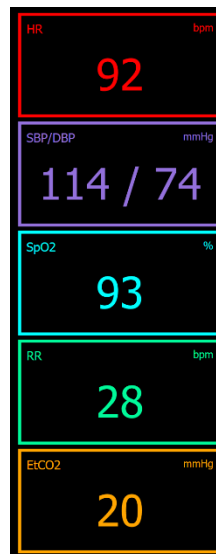


Figure 16

Touching the vital box will bring up a pop-up window which will show how the vital has changed over the course of the session (Figure 17).

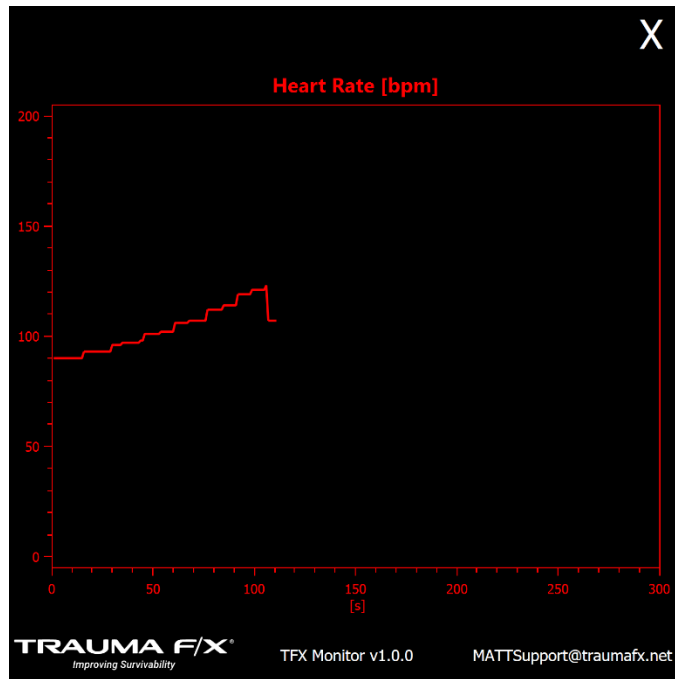


Figure 17

Alarms

When a vital is above the upper threshold or below the lower threshold an alarm will sound. An alarm also sounds if the ECG waveform is a life-threatening waveform, that is asystole, ventricular fibrillation, supraventricular tachycardia, or ventricular tachycardia. If the heart beat cannot be detected (asystole, VFIB), the alarm is a continuous 1kHz tone. Otherwise the alarm consists of 5 short 900Hz beeps followed by about 5 seconds of silence. This alarm repeats until the vital is within the normal range or the alarm is silenced.

While the alarm is playing, the alarm button will flash red (Figure 18).



Figure 18

Any vital that triggered the alarm will gain a white background and the vital text will blink with the flashing alarm button (Figure 19).

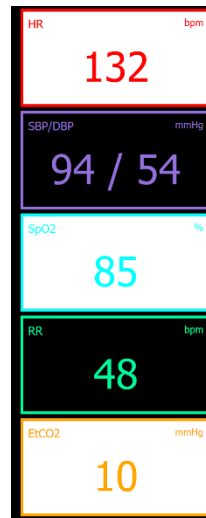


Figure 19

The message box on the top left of the screen will show a timestamped message describing which vital has triggered the alarm.

To silence the alarm, press the alarm button. The Alarm button will then turn light green and the alarm will stop. The vital that triggered the alarm will stop blinking, but the background will remain white while the vital is still in the alarm range.

The alarm message box will turn light green if the alarm is silenced or the vital returns to normal. The alarm message is only cleared when the session is reset on the remote or if the Clear button is pressed on the monitor.

All waveforms and sounds will also stop if the session is paused or stopped on the remote.

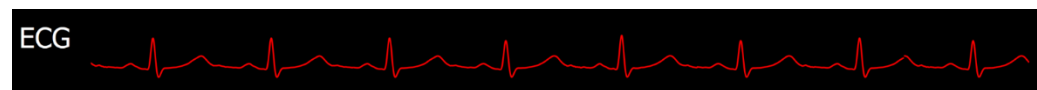
ECG Waveforms

The following ECG waveforms are available on the VSM.

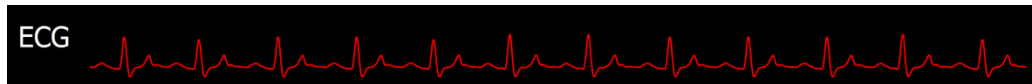
Sinus Bradycardia



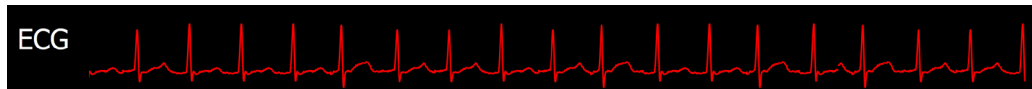
Normal Sinus Rhythm



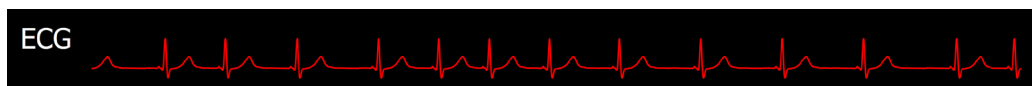
Sinus Tachycardia



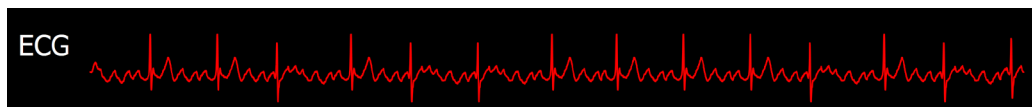
Supraventricular Tachycardia



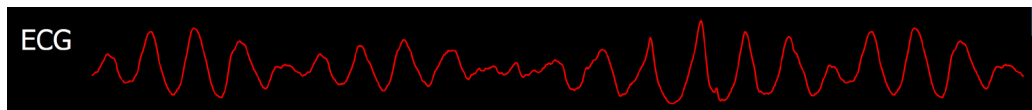
Atrial Fibrillation



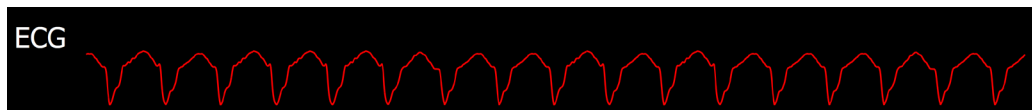
Atrial Flutter



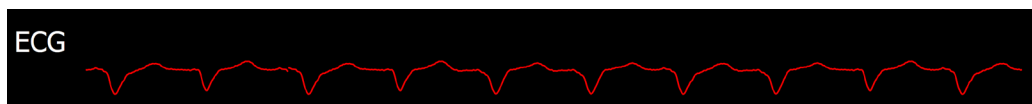
Torsades de Pointe



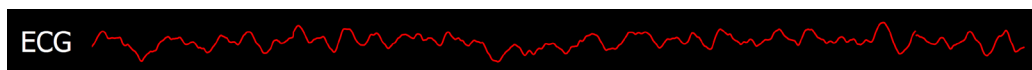
Ventricular Tachycardia



Pulseless Electrical Activity



Ventricular Fibrillation



Asystole

ECG

First Degree Heart Block

ECG

Second Degree Heart Block Type I (Wenckebach)

ECG

Second Degree Heart Block Type II (Mobitz II)

ECG

Complete/Third Degree Heart Block

ECG

Pacing Capture

ECG

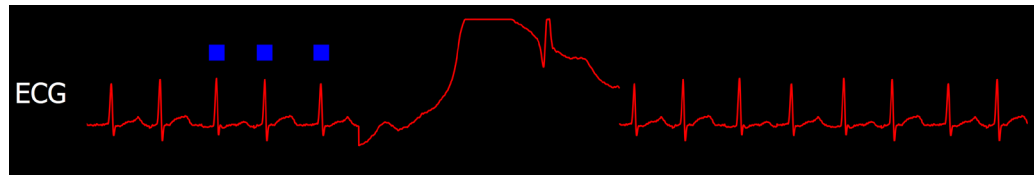
Shock Waveform

VFIB, pVT, and unstable Tachycardias can be shocked when operating the RC Transmitter in ACLS mode. When the Shock button is pressed on the Remote, the shock waveform will be inserted into the current displayed ECG waveform.

ECG

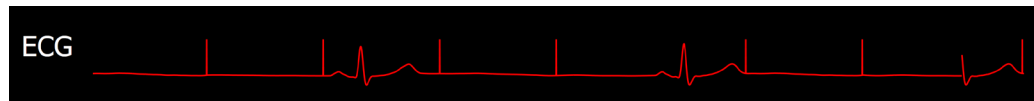
Synchronized Cardioversion

You can perform synchronized cardioversion on any unstable Tachycardia waveform in ACLS mode. After the Sync button is pressed on the Remote, sync markers will appear on every R wave. When the Shock button is pressed, the shock waveform appears on the next beat.



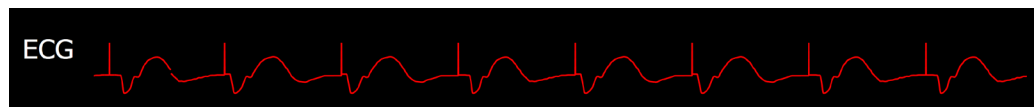
Pacing Spikes

When operating the RC Transmitter in ACLS mode after pacing has been initiated (by pressing the Pace button on the remote), pacing spikes will appear on the underlying ECG waveform at the pacing heart rate.



Pacing Capture

Once capture has been achieved, simulated by pressing the Capture button on the remote, the waveform will switch to the pacing capture waveform and the heart rate will change to the pacing heart rate.



Packing

Prior to storing the VSM, always perform the following procedures:

1. **Power down** the Surface Go.
2. **Remove** the battery from the back of the VSM case

Chapter 5: After Use Care



To keep the VSM operating as designed, the following preventive maintenance actions must be completed after each training session.

These easy to perform maintenance actions will help ensure the VSM remains in peak operating condition for each training session:

1. **Remove battery** daily after training is complete. Do not store the Makita battery on the VSM case as this could cause the battery to fail.
2. **Fully recharge the battery** after each training exercise. To extend the service life of the batteries, do not run the batteries until they are completely out of charge.
3. **Do not use** a partially charged battery as this will cause the VSM to not operate properly.
4. **Only use** approved chargers supplied with the TraumaFX upper or lower unit to recharge the batteries.
5. **Read the User's Manual** for the Battery Chargers and follow instructions and precautions listed inside the manual.

Chapter 6: Troubleshooting

Contact TraumaFX Technical Support at: MATTsupport@traumafx.net, or 1-800-200-7465 if trouble-shooting steps do not resolve an issue you are experiencing.

Issue	Actions
Condensation appears on the screen	<ul style="list-style-type: none"> Store in a cool, dry place and do not subject the VSM to wet conditions.
The VSM will not turn on	<ul style="list-style-type: none"> Verify the Surface is charged, and the Makita battery is fully charged Verify that the charging cable is properly attached to the Surface Go.
VSM is not pairing to the RC Transmitter	<ul style="list-style-type: none"> Check to see if the VSM is turned on. Verify the USB-C connector is plugged into the Surface Go Is the RC Transmitter showing “Paired” with the upper or lower unit Ensure all batteries in the both the VSM and RC transmitter are fully charged.

Additional Support

Customer Service and Support

For other troubleshooting issues not identified above, please contact TraumaFX Technical Support at MATTsupport@traumafx.net, or 1-800-200-7465.

Appendix

A

Appendix A – Vital Signs Monitor Technical Specifications

Vital Signs Monitor

Weight: 5 lbs.

Power Supply: One (1) 7.66V (3.411mAh) Li-ion battery inside the Surface Go, and One (1) Makita 18 V (3.0-5.0Ah) Li-ion battery

Effective Range: Outdoor range is 200 meters (line of site); indoor range is 50 meters but is subject to building construction materials that may impede signal.

Power supply: 18v Lithium Ion Battery

Indoor or Outdoor Use

Altitude Rating: Altitude up to 2000 m

Temperature Rating: Temperatures between 32°F and 104°F (0°C to 40°C)

Humidity Rating: Maximum relative humidity 80% for temperatures up to 88°F (31°C) decreasing linearly to 50% relative humidity at 104°F (40°C)

IP Rating: IP40

Transmit power: 63mW (18dBm)

RF Data Rate: 250,000 bps

FCC ID: Contains FCC ID: OUR-XBEEPRO** The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (i.) this device may not cause harmful interference and (ii.) this device must accept any interference received, including interference that may cause undesired operation.

FCC Approval: Systems that include XBee/XBee-PRO Modules inherit MaxStream's Certifications. FCC ID: OUR-XBEEPRO

ISM (Industrial, Scientific & Medical): 2.4 GHz frequency band
Manufactured under ISO 9001:2000 registered standards XBee/XBee-PRO RF Modules are optimized for use in US, Canada, Australia, Israel, and Europe (contact MaxStream for complete list of approvals).

IMPORTANT: The XBee/XBee-PRO OEM RF Module has been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Modifications not expressly approved by MaxStream could void the user's authority to operate the equipment.

Makita DC18RC Battery Charger

Input: A.C. 120 V 50 – 60 HZ

Output: D.C. 7.2 V – 18 V

Weight: 1.0 kg (2.2 lbs)

INDEX

after each use, 2
after use care, 5, 21
batteries, 5, 7
battery charger. *See* Charger
charger, 5, 6
compliance, 3
Customer Service, i, 22
Technical Specifications, 23
training, 1, 4, 5, 6, 21
transmitter, 21
warranty, 1, 5
water resistant, 2