

# **SQA-V** *Gold*

## **USER GUIDE**

**V e r s i o n   2 . 4 8**  
**W H O 3<sup>rd</sup> and 4<sup>th</sup>**

**Jan 2024**

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## Specifications

**SQA-V Gold**  
Version 2.48

## SECTION 1: System Specifications and Requirements

Dimensions: 32 X 30 X 24 cm  
Weight: 7 kg  
AC power supply: 100 to 240 VAC, 50-60 Hz, 20 VA

### Archive Capacity

- 500 test records
- 750 QC records

### Display(s)

- Operational backlight LCD (16 lines x 40 characters)
- Video backlight LCD (8 x 10 cm)

### Factory Default Settings

#### SYSTEM:

**Date format:** DD/MM/YY (Europe)

**Time/Date:** Manufacturer's local time/date

**Morphology:** WHO 3rd

**Chamber standard:** 2

**Printing Options:** Automatic / Printer Type: Ink

#### CONTROLS:

**Control Media:** Latex Beads

(Lot #, Target Values, +/- Ranges should be set up by the user before running controls)

### Front Panel

- Built-in printer
- Visualization compartment
- LCD video display and controls
- Focus knob
- LCD operational display
- Measurement compartment
- Multi-button keypad

### Keypad

- **Operational keys:** ON/OFF, TEST, PRINT, SERVICE, ARCHIVE (now disabled), DELETE, ENTER, four cursor buttons, ESC, ten numeric buttons (0-9)
- **Video control keys:** ZOOM IN/OUT, ILLUMINATION HIGH/LOW, and MONITOR ON/OFF

### Measurement Compartment

- **Sources of radiant energy** - two LEDs for motility and spectrophotometry channels
- **Detector system** - two photo detectors - Motility and Optical Density

### Operating System

- **Analysis Time:** Normal Test – 75 seconds; Low Quality – 2 minutes; Postvasectomy – 5 minutes.

- **Software:** Resides on flash memory and drives all man-machine interface functions, runs algorithms for test measurements (according to WHO 4<sup>TH</sup> guidelines), and operates visual and automated screens. System can be upgraded from a PC CD-ROM.
- **Motility channel input signal:** Analog, up to 5V.
- **Spectrophotometer channel input signal:** Modulated (1 kHz) analog, up to 5V.

### Printer

- Built-in thermal printer (CASHINO).
- Thermal printer paper roll (CASHINO).

### Rear Panel

- Power connector with fuse-holder (fuse 250V, 1A)
- Video connector
- RS232 cable outlet

### Visualization Compartment

- White LED illumination system
- CCD, 330 TV lines
- Objective: Standard, x20
- Signal Output: PAL standard
- Zoom system for smooth magnification transition between x300 and x500
- Focus regulator

### Maintenance Schedule

## Requirements

- **Daily:** Clean measurement compartment daily when running samples and after every 10-15 tests and/or for ANY spillage. Follow manufacturer's cleaning instructions using manufacturer cleaning kit. (Refer to the appendix section "Cleaning the Capillary/Slide Compartments" in this User Guide) **ONLY use the Manufacturers cleaning kit and cleaning brush or damage will occur to the SQA-V film and the system will not operate!**

### Manufacturer Recommendations

- Operate the SQA-V away from devices that may cause electronic noise (cell phones) or other devices causing vibrations such as centrifuges.
- Turn system **OFF** at the rear-panel when not in use for extended period of time.
- When running Postvasectomy tests do not interrupt test cycle nor interfere with system or testing capillary in any way – this test is highly sensitive to any motion and requires complete stability of the system during the 5 minute testing cycle.
- Variations in ambient temperature can affect semen samples. It is essential that semen samples are not heated when testing. The SQA-V is calibrated to conduct tests at room temperature: 20-25°C (68-77°F).
- Semen is considered a biologically hazardous material and is subject to individual laboratory protocols for handling such materials.

## Operating Temperature

- Operates in a wide range of ambient temperatures (15-38°C) however the system is calibrated to measure semen samples at room temperature: 20-25°C (68-77°F). Note: Extreme ambient temperature may impact the accuracy of motility test results because of the known effect of temperature on human semen
- System is fully operational at up to 80% humidity.

## PC / Hardware Requirements

Minimum requirements for V-Sperm software

- **PC:** 1 GHz processor, Pentium 3
- **RAM:** 256 MB
- **AGP-video display card** with at least 16 MB of RAM memory
- **Video color:** At least 16 bit (65,535)
- **CD ROM drive**
- **2 GB free hard disk space** for image capturing (approx. 3000 clips)
- **Video resolution:** Minimum 640 x 480
- **Operating system compatibility:** Windows XP and VISTA; Excel/Word (required for V-Sperm GOLD)
- **Ports:** One serial; two USB ports
- **Monitor:** 15" color

## Quality Control

- **Internal:** Electronic Self-Test and Auto-Calibration. Runs automatically upon start-up. Reference values are verified prior to each test.
- **External:** Run daily prior to testing or per laboratory protocol. Runs non-assayed: Latex beads or stabilized sperm for concentration and negative control for motility/concentration. Assayed control: "**QwikCheck™-beads**" (product of Medical Electronic Systems).

## Sample Testing

- **Sample Testing Temperature:** Calibrated for room temperature only. Motility results will be impacted by heating the specimen.
- **System calibrated to test Human semen and specified Control samples only.** Not for use with animal semen.
- **SQA-V measurement capillary:** Disposable, plastic, testing capillary. Requires 500 µl of sample for normal volume testing, 20 µl for low volume testing, 300 µl for diluted mode. Use only manufacturers' certified testing capillaries in the automated and visualization system.
- **Slide adaptor:** Supplied with the SQA-V. Must be used with a standard laboratory slide and 22 x 22 mm cover-slip for accurate test results.

## Software Required

- **V-Sperm Gold (included with system):** Required for setting SQA-V system defaults, archive management/data transfer, capture and storage of video images from the SQA-V and for displaying and printing self test data.

## SECTION 2: System Overview

The SQA-V is a high performance analytical medical device that combines technology in electro-optics, computer algorithms and video microscopy. The system performs a 75-second semen analysis and has the ability to print test results and archive up to 500 patient records. The system is self-testing and self-calibrating and runs latex beads or stabilized sperm quality controls. Two systems: **Automated** and **visualization** allow the user the flexibility to analyze all types of semen samples.



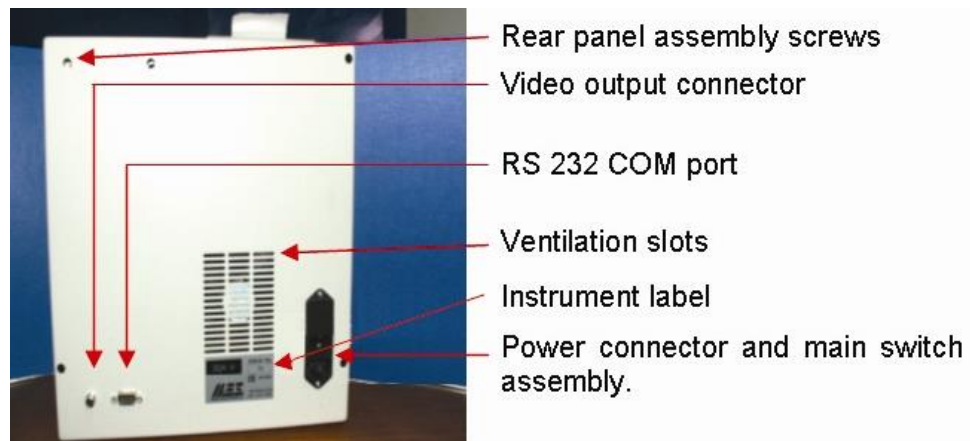
**NOTE:** The **TEST** button of the SQA-V keypad is only active in the **CALIBRATION** mode.

The **ARCHIVE** button on the keypad is inactive because the SQA-V archive is managed through V-Sperm GOLD.

### Keypad Navigation

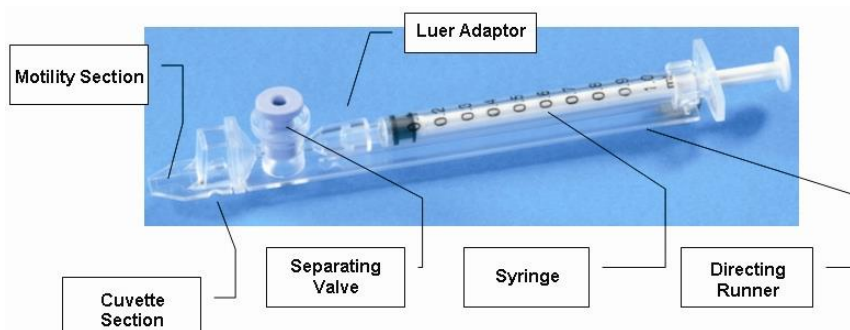
- Use **NUMERIC** keys to enter data; **ARROW** keys to move to the next field.
- Press **ENTER** to select menu options, confirm data entries and to move to the next screen or field.
- Use the **ESC** button to return to the previous screen or field.

### Rear Panel



## SQA-V Components

### Measurement Capillary



- Disposable, designed to collect and test samples in a biologically safe manner.
- Motility is measured in the 0.3 mm (thin) "Capillary Section." This section requires 20 micro liters of semen.
- Concentration is measured in the 10 mm (tall) "Cuvette Section." This section requires 450 microliters of semen.
- Both the measurement and visualization chambers of the SQA-V will accommodate the testing capillary. Refer to: "Filling the SQA-V Capillary with Normal and Low Volume Samples" in the Appendix section of this guide for instructions on how to use the SQA-V testing capillary.

### Slide Adaptor

#### NOTE:

In order to accurately visualize the sample it must be centered approximately 12mm from the end of the glass slide.



- Use with a standard laboratory slide 76 x 25.6 mm and 22 x 22 mm cover-slip with a 10 µl sample placed approximately 12 mm from the end of the slide for accurate results.
- For use in the **visualization compartment** of the SQA-V.



**Automated  
Test Results**

**Semen Parameters Reported by the SQA-V**

Semen Parameters with SQA-V Abbreviation in Brackets			
Sperm Concentration (SPERM CONC.)	M/ml	Motile Sperm Concentration (MSC)	M/ml
Motility (MOTILITY <a + b + c>)	%	Progressively Motile Sperm Conc (a) (PMSC <a>)	M/ml
Rapid Progressive Motility (a) (RAPID PROG. MOTILITY <a>)	%	Progressively Motile Sperm Conc (b) (PMSC <b>)	M/ml
Slow Progressive Motility (b) (SLOW PROG. MOTILITY <b>)	%	Functional Sperm Concentration: Prog. Motile Sperm w/Norm Morphology (FSC)	M/ml
Non Progressive Motility © (NON PROG. MOTILITY <c>)	%	Total Number Sperm / Ejaculate (SPERM #)	M
Immotility (d) (IMMOTILITY <d>)	%	Total Progressive Sperm / Ejaculate (PROG. SPERM)	M
Morphology: % Normal Forms (MORPH. NORM. FORMS,WHO 3 <sup>rd</sup> / 4 <sup>th</sup> )	%	Total Motile Sperm / Ejaculate (MOT. SPERM)	M
Velocity (VELOCITY)	mic. /sec.	Total Functional Sperm / Ejaculate (FUNC. SPERM)	M
Postvasectomy: Motile, Immotile and Total Sperm/Scan (#SPERM/SCAN: MOTILE, IMMOTILE and TOTAL)	#	Sperm Motility Index (SMI)	#
		Postvasectomy: Motile, Immotile and Total Sperm/sample volume (#SPERM/SAMPLES VOLUME: MOTILE, IMMOTILE AND TOTAL)	M

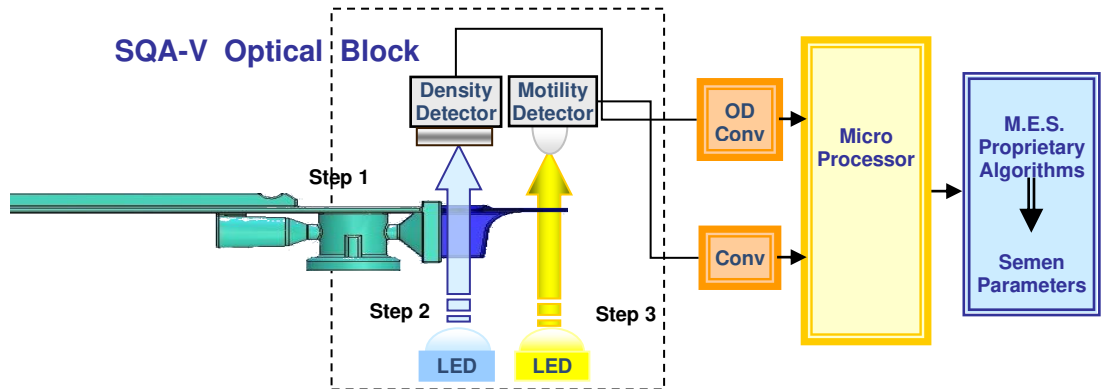
**Table of the Dynamic Range of the SQA-V**

**Dynamic  
Range**

DYNAMIC RANGE OF THE SQA-V Gold			
SAMPLE	SPERM CONC in M/ml	MSC in M/ml	Motility %
FRESH	2-400 or < 2 M/ml	0.2-400 or <0.2 M/ml	0-100%
WASHED	2-200 or < 2 M/ml	0.2-200 or <0.2 M/ml	0-100%
FROZEN	Not reported	0.2-200 or <0.2 M/ml	Not reported
POSTVASECTOMY	Manual Input	0-30 Sperm/Scan	Not reported

## Technology

### SECTION 3: Technology



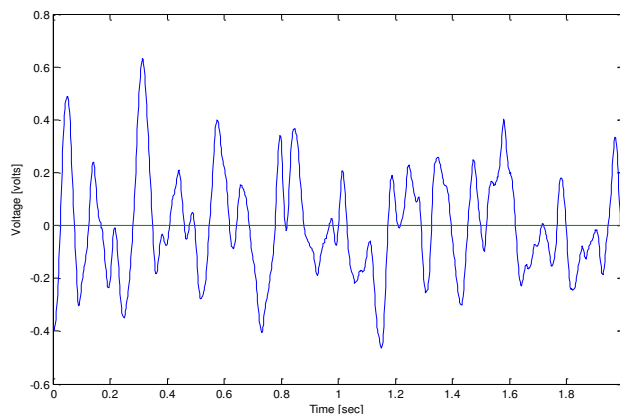
**Step 1: The capillary is inserted into the measurement compartment.**

**Step 2: Concentration:**

- Millions of sperm cells are analyzed: A very specific wavelength of light is absorbed by the sperm cells in the concentration chamber of the SQA-V testing capillary.
- An optical density detector measures the amount of light absorbed by the cells and converts it to optical density (OD).
- The "OD" reading is translated into sperm concentration by a microprocessor based on proprietary MES algorithms.

**Step 3: Motility:**

- Tens of thousands of sperm cells are analyzed in the thin section of the SQA-V capillary as they move through a light beam in the SQA-V: The movement of motile sperm cells causes light disturbances.
- These light disturbances are converted into electronic signals with "peaks and valleys."
- The electronic signal peaks are analyzed by microprocessor software based on a proprietary MES algorithm and translated into motility parameters.



**Electronic Signal of Motile Sperm**

## SECTION 4: Getting Started / Set-Up

### Power-On

- Attach factory supplied electrical cable to the outlet on the rear panel.
- Plug cable into a grounded electrical source.
- Turn on SQA-V by pressing the main switch located on the rear panel. The **Power** indicator will illuminate and the following screen will be displayed.

SQA-V VERSION 2.48  
STANDBY POSITION  
  
PRESS ON/OFF KEY  
TO ACTIVATE THE UNIT

### Auto-Calibration and Self-Test

SQA-V VERSION 2.48  
PLEASE WAIT  
SYSTEM STABILIZATION AND  
AUTOCALIBRATION

#### NOTE:

Do not insert a capillary/slide into the device during the stabilization process.

Do not use any of the keyboard functions during stabilization.

- Press **ON/OFF** key on the keypad and system stabilization and auto-calibration will begin.
- This process takes 5-7 minutes.
- When the system stabilization and auto-calibration processes are complete, a series of tests will be run.
- Do not insert a capillary/slide into the device or use any of the keyboard functions until instructed to do so by the system.
- The MAIN menu will appear when the self-test process is complete. The SQA-V is now ready for use.

**MAIN MENU**

**TEST NEW PATIENT  
RUN CONTROLS  
SERVICE**

## Set-up System Defaults

SQA-V system defaults are set-up through V-Sperm GOLD software. Therefore a connection needs to be established between the SQA-V and the PC.

- From the **MAIN MENU**, select **SERVICE > SERVICE DATA**.

**SERVICE MENU**

**SERVICE DATA**  
 SERVICE PERSONNEL  
 PRINT SELF-TEST DATA

**SERVICE DATA**

1. 18	8. 112	15. 1.3
2. 5	9. 10	16. 110
3. 150	10. 6	17. 2
4. 28	11. 89	18. 1000
5. 77.65	12. 31	19. 2
6. 512	13. 100	
7. 0.000	14. 100	

- The RS232 communication cable must be connected to the SQA-V and the PC.
- Turn-on the PC and activate the V-Sperm GOLD version 3.48 software
- From the V-Sperm GOLD main navigation screen select **SET-UP > SQA-V > SQA-V Defaults**. Then press the **CONTINUE** button.
- V-Sperm GOLD will display the SQA-V system set-up screen:

**SQA-V set-up  
screen from  
V-Sperm GOLD**

**CONTROL set-up  
screen from  
V-Sperm GOLD**

**System**

Choose date format

☒ Europe (DD/MM/YY)

☐ USA (MM/DD/YY)

SQA-V Date

Enter local date 19/11/2015

Morph. Criteria

☒ WHO 3rd

☐ WHO 4th

Conc./Chamber Standard

☐ 1 ☒ 2

Printing Options

☒ Automatically print all test results

☒ Automatically print Self Test Report on Start Up

Printer Type: ☐ Thermal ☒ Ink

LES

☐ 1 (US) ☒ 2 (ROW)

**Control**

Control Media

☒ Latex Beads ☐ Stabilized Sperm

Level 1			Level 2			Negative Control		
Lot #			Lot #			Lot #		
Exp. Date	11/15		Exp. Date	11/15		Exp. Date	11/15	
	Target Value	+/- Range		Target Value	+/- Range		Target Value	+/- Range
Automated	30	5	Automated	20	3	Automated	0.0	0.0

Report
Apply
Cancel

**NOTE:** All Set-up fields must have data in order to transfer information to the SQA-V. If CONTROL settings are not known, enter "0" LOT #/ Target Value/+/- Range. Enter current date for the date field.

**NOTE:** The **Set-up** data transfer may take several minutes! Please wait....

**NOTE:** Factory default settings are listed in **RED**.

## Testing Samples

## Patient Information

### PLEASE NOTE:

The SQA-V is calibrated to run semen specimens at room temperature. It is not necessary nor will the user get accurate motility results if the sample is heated to 37°C.

- **SQA-V System Default settings:**
  - Date Format (DD/MM/YY) or (MM/DD/YY)
  - Local date setting
  - Conc./Chamber Standard 1 or 2 (See appendix section for more information)
  - LES setting – use '1' if you operate in the U.S. or '2' if the system will be operating outside of the U.S.
  - Morphology Criteria (WHO 3<sup>rd</sup> or WHO 4<sup>th</sup> Strict)
  - Printing options: automatically print test results/self test report on start-up.
  - Printer type: Set only to INK
- **Control Set-up (from the manufacturer's labeling):**
  - Select type of control: Latex beads or Stabilized Sperm.
  - Enter Lot Number for each control level (enter "0" if not known).
  - Enter +/- Range for each control level (enter "0" if not known).
  - Enter EXPIRATION date (use current date if EXP date not know).
- Press the **Report** button to view and print the selected default settings.
- Press **Apply** to accept the default settings and transfer them to the SQA-V.

## SECTION 5: Testing Semen Samples

Information about the patient and sample is entered prior to the testing process. In order to accurately "classify" the semen sample by type and volume and understand the options for testing, refer to the information below.

### Entering Patient and Sample Information

ENTER PATIENT / SAMPLE DATA		
PATIENT ID:	5788114	
BIRTH DATE:	01/01/85	
ABSTINENCE:	4 DAYS	
SAMPLE PROCESSING		
SAMPLE / ACCESSION #	88	
COLLECTED:	DD/MM/YY	HH:MM
RECEIVED:	DD/MM/YY	HH:MM

- From the **MAIN MENU** select **TEST NEW PATIENT** and the **ENTER PATIENT/ SAMPLE DATA** screen is displayed.
- Enter the requested sample/patient information using the SQA-V keypad:
  - **PATIENT ID** – Unique number identifying the patient (Maximum of 20 numbers can be entered).
  - **BIRTH DATE** – Birth date of the patient.
  - **ABSTINENCE** – Number of days since the patient's last ejaculation.
  - **SAMPLE/ACCESSION #** – Up to 20 numbers identifying the sample
  - **COLLECTED** – Date and time the sample was collected.
  - **RECEIVED** – Date and time the sample was received.

## Sample Information

Press **ENTER** to view the next screen:

SAMPLE TYPE	
<b>SELECT</b>	FRESH / WASHED / FROZEN / POSTVASECTOMY
VOLUME	2.5 ml
WBC CONC.	<b>SELECT</b> < 1 M/ml / OR >= 1 M/ml
PH	7.0
APPEARANCE	NORM./ABNORM.
LIQUEFACTION	NORM./ABNORM.
VISCOSITY	NORM./ABNORM.

### Sample Data

- Select: **SAMPLE TYPE** (required entry) based on the following options:
  - **FRESH** – Sample not enriched, diluted or treated and is within 1 hour of collection. Exception: Low volume samples diluted 1:1 with QwikCheck dilution media can be used according to User Guide instructions.
  - **WASHED** – Sample enriched or prepared for artificial insemination using a commercial media to replace seminal plasma. Frozen samples containing egg yolk buffer are excluded.
  - **FROZEN** – Samples that have been frozen. Only motility parameters will be reported (MSC, PMSC, SMI and VELOCITY) in order to quantify the impact of freezing and thawing on the motility parameters of the specimen.
  - **POSTVASECTOMY** – Fresh samples designated as postvasectomy and tested within an hour of collection.
- Enter the remaining sample information using the SQA-V keypad:
  - **VOLUME** – Volume of the **whole** ejaculate in milliliters
  - **WBC CONC.** – select < 1 M/ml (normal) or >= 1 M/ml (abnormal) leukocytes (required entry). (QwikCheck Test Strips recommended).
  - **PH** – pH of the semen sample (QwikCheck Test Strips recommended).
  - **APPEARANCE** – NORM/ABNORM visual assessment of the specimen
  - **LIQUEFACTION** – NORM/ABNORM (NORM - liquefies within 60 minutes @ room temperature).
  - **VISCOSITY** – NORM/ABNORM (See WHO 4<sup>TH</sup> guidelines).
- If **POSTVASECTOMY SAMPLE TYPE** was selected, please refer to the section "Postvasectomy Test" in this user guide.

### Sample Volume

<p>IS SAMPLE VOLUME SUFFICIENT FOR COMPLETE TESTING &gt;= .5 ml?</p> <p>YES/NO</p>
--

- After entering the patient and sample data, the screen above will be displayed.
- Using the left and right arrow keys and then **ENTER**, select:
  - **YES** for **NORMAL VOLUME** samples ≥ 0.5 ml.
  - **NO** for **LOW VOLUME** samples < 0.5 ml.

#### PLEASE NOTE:

Refer to the appendix section of this user guide for information on how to measure semen WBC's and pH and how to handle viscous samples.

## Low Volume Samples

### Please note:

Prior to each running a test, the system will perform autocalibration (do not insert a capillary until instructed to do so on the screen.)

- If the sample is < 0.5 ml two options are available: Run as a low volume sample and obtain just motility parameters or dilute the sample 1:2 (1+1) with QwikCheck Dilution media and obtain a report of all parameters.
- To run a low volume sample: Aspirate only 20 µl of sample into the motility section of the capillary following the instructions in the Appendix section of this User Guide: "Filling the SQA-V Capillary with a Low Volume Samples".

<p>LOW VOLUME SPECIMEN</p> <p>PLEASE SELECT SAMPLE TESTING OPTION:  DILUTE SEMEN 1:2 (1+1) WITH MEDIA  <b>LOW VOLUME – 20 MICROLITERS ONLY</b>  MOTILITY PARAMETERS ONLY</p>
<p>LOW VOLUME SAMPLE</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> FILL CAPILLARY – 20 MICROLITERS  CLEAN AND WIPE CAPILLARY </div> <p><b>INSERT CAPILLARY INTO CHAMBER</b></p>
<p>TEST RESULTS</p> <p>MOTILITY PARAMETERS ONLY</p> <p>PMSC &lt;a&gt; 1.1 M/ml    VELOCITY 5 mic/sec  PMSC &lt;b&gt; 7.2 M/ml    SMI            26  MSC        18.5 M/ml</p> <p>TOTALS PER EJACULATE</p> <p>MOT SPERM 18.5M    PROG SPERM 8.3M</p>

## Diluted Samples

### Please note:

**See the appendix**  
section of this guide for  
information about  
dilution media.

- Or the low volume sample can be diluted 1:2 (1+1) with QwikCheck-Dilution media:

<p>LOW VOLUME SPECIMEN</p> <p>PLEASE SELECT SAMPLE TESTING OPTION:  <b>DILUTE SEMEN 1:2 (1+1) WITH MEDIA</b>  LOW VOLUME – 20 MICROLITERS ONLY  MOTILITY PARAMETERS ONLY</p>
<p>LOW VOLUME SPECIMEN</p> <ol style="list-style-type: none"> <li>1. DILUTE SEMEN 1:2 (1+1) WITH MEDIA</li> <li>2. MIX DILUTED SAMPLE THOROUGHLY</li> <li>3. FILL, CLEAN AND WIPE CAPILLARY</li> <li>4. WAIT FOR AUTOCALIBRATION</li> </ol> <p><b>INSERT CAPILLARY INTO CHAMBER</b></p>

- Follow the instructions in the appendix section of this User Guide: Filling the SQA-V Capillary with a Normal Volume Sample.
- The testing cycle and test results will be the same as a normal volume specimen (see screens below).

## Normal Volume Samples

### PLEASE NOTE:

The SQA-V will begin testing when a capillary is placed into the testing chamber.

- The SQA-V algorithm compensates for the sample dilution as long as the sample has been diluted accurately (If the total sample volume is 0.4 ml then 0.4 ml of a clear media such as Earle's buffer must be added).
- Recommendation: If the LOW VOLUME sample is viscous, FIRST treat with the OwikCheck-Liquefaction kit and then dilute the sample for greater accuracy.

FRESH  
NORMAL VOLUME SPECIMEN

1. MIX SAMPLE THOROUGHLY
2. FILL, CLEAN AND WIPE CAPILLARY
3. WAIT FOR AUTOCALIBRATION

**AUTOCALIBRATION – DO NOT TOUCH UNIT**

- If the sample was  $\geq 0.5$  ml the screen above will provide instructions for PREPARING a testing capillary.
- Fill the SQA-V testing capillary according to the instructions in the Appendix section of this user guide: "Filling the SQA-V Capillary with a Normal Volume Sample".

FRESH  
NORMAL VOLUME SPECIMEN

1. MIX SAMPLE THOROUGHLY
2. FILL, CLEAN AND WIPE CAPILLARY
3. WAIT FOR AUTOCALIBRATION

**INSERT CAPILLARY INTO CHAMBER**

- The screen above will be displayed when it is time to INSERT the filled testing capillary in the measurement compartment, testing will begin automatically.

## Testing

A sample is tested in approximately 75 seconds. If the sample is low quality, the system will perform an additional 2 minute test:

TESTING

DO NOT MOVE CAPILLARY OR  
OPERATE DEVICE DURING TESTING

TESTING

LOW QUALITY SAMPLE

TESTING WILL TAKE 2 MORE MINUTES



## Test Results

TEST RESULTS	
SPERM CONC.	32.6 M/ml
MOTILITY <a+b+c>	28.0 %
RAPID PROG. MOTILITY <a>	5.2 %
SLOW PROG. MOTILITY <b>	14.1 %
NON PROG. MOTILITY <c>	8.7 %
IMMOTILITY <d>	72.0 %
MORPH. NORM. FORMS, WHO 3 <sup>rd</sup>	20.6 %

TEST RESULTS			
MSC	9.1 M/ml	FSC	2.5 M/ml
PMSC <a>	1.7 M/ml	VELOCITY	9 mic/sec
PMSC <b>	4.6 M/ml	SMI	34
TOTALS PER EJACULATE			
SPERM #	81.5 M	MOT. SPERM	22.8 M
PROG. SPERM	15.8 M	FUNC SPERM	6.3 M

## Low Quality Test Results

- Low quality sample semen parameters may be reported as < or > when one or more of the parameters falls below the SQA-V dynamic range. Only basic parameters can be reported: Sperm Concentration, Motility, SMI and Motile Sperm Concentration due to the limited number of cells, very low motility and/or poor morphology.
- Examples of test results reported in this manner are seen in the screens below:

TEST RESULTS	
SPERM CONC.	2.7 M/ml
MOTILITY <a+b+c>	< 5 %
RAPID PROG. MOTILITY <a>	%
SLOW PROG. MOTILITY <b>	%
NONPROG. MOTILITY <c>	%
IMMOTILITY <d>	%
MORPH. NORM. FORMS, WHO 3 <sup>rd</sup>	%

TEST RESULTS			
FSC	M/ml	MSC	< 0.2 M/ml
PMSC <a>	M/ml	VELOCITY	mic/sec
PMSC <b>	M/ml	SMI	0
TOTALS PER EJACULATE			
SPERM #	N.A.	MOT. SPERM	N.A.
PROG.SPERM	N.A.	FUNC SPERM	N.A.

- The test results will be saved/printed automatically or an option to save and print will be displayed depending on how the SQA-V was set-up.

**Printing  
Saving and  
Transferring  
Test Results  
to V-Sperm**

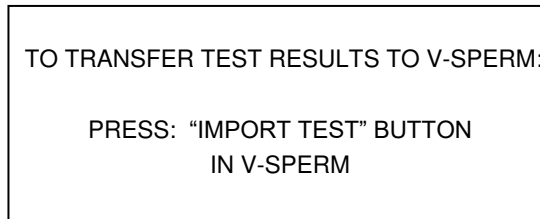
**PLEASE NOTE:**

The SQA-V archive is viewed from V-Sperm only. The archive must be transferred to the V-Sperm PC in order to view, delete and edit records.

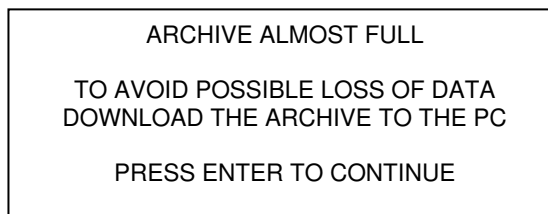
- If the SQA-V default was set to automatically print/save test results, the screen below will now be activated.



- Immediately after saving/printing test results, an option to transfer the results of the test just completed to V-Sperm is displayed on the SQA-V.
- V-Sperm Gold must be activated and the PC must be connected via the RS232 cable to the SQA-V
- Following the screen directions, simply PRESS the "Import Test" main menu navigation button in V-Sperm and the test will automatically be transferred into the V-Sperm data base.



- The archive of the SQA-V can accommodate 500 Patient Test records and 750 QC tests. A warning will appear when the archive is almost full. Data **MUST** be transferred to the PC or it will be lost, overwritten or the SQA-V will no longer permit testing.



- To transfer the archives to the PC:
  - From the SQA-V, go to **MAIN MENU > SERVICE > SERVICE DATA.**
  - Make sure the RS232 communication cable is connected between the SQA-V and the PC.
  - Turn-on the PC and activate the V-Sperm GOLD version 3.48 software
  - From the V-Sperm GOLD main navigation screen select **IMPORT/EXPORT > IMPORT DATA >** select either **IMPORT ARCHIVE (PATIENT RECORDS).**
  - Press **CONTINUE** and the records will automatically be transferred.
  - After all the records have been successfully transferred to V-Sperm, select YES on the next screen to delete the SQA-V (Patient)archive from the SQA-V.

## Postvasectomy Test

The SQA-V runs a five minute POSTVASECTOMY test that can detect the presence of a very small number of motile cells. Once the automated test has been performed, the user is given the option to follow the POSTVASECTOMY protocol outlined below and "scan" the testing capillary in the SQA-V visualization system (A POSTVASECTOMY Protocol can also be found in the appendix section of this guide).

By scanning through the depth of the testing capillary, immotile and motile sperm cells can be readily identified, easily counted and entered in the operational screen for visual confirmation of the automated test results. Clinical studies positively demonstrated that by incorporating both the SQA-V automated AND visualization system in the testing protocol, a very high level of accuracy is obtained for identifying motile and non-motile sperm cells in POSTVASECTOMY samples.

In order to obtain similar levels of accuracy it is imperative that the user strictly follow the manufacturer's protocol outlined below. Additionally, once the testing cycle is completed, test results can be documented by capturing and archiving a video clip of the postvasectomy specimen using V-Sperm™ software.

- Select **POSTVASECTOMY** as the SAMPLE TYPE from the ENTER PATIENT / SAMPLE DATA screen.
- There are minimal to no cells present in a POSTVASECTOMY specimen. Therefore, the specimen needs to be centrifuged and the pellet re-suspended in order to concentrate the specimen and increase the likelihood of finding cells. The screen below will instruct:

CENTRIFUGE SAMPLE AND RESUSPEND  
PELLET  
PER USER GUIDE

PRESS ENTER WHEN READY

- Centrifuge the specimen at 600g for 15 minutes.
- Decant the supernatant and re-suspend the pellet in 0.8 ml QwikCheck dilution media, seminal plasma or other washing media.
- Fill the SQA-V testing capillary following instructions in the appendix section of this guide: "Filling the SQA-V Capillary with a Normal Volume Sample."

**Please note:**

The POSTVASECTOMY test takes approximately 5 minutes to run and is highly sensitive to motion. Please do not disturb the SQA-V or the testing capillary during the testing cycle or the results may be impacted.

- Insert the testing capillary into the SQA-V lower chamber when instructed. Testing will begin automatically.
- Testing takes approximately 5 minutes.
- Test results for motile sperm are reported.
- Select **YES** to when asked: "ENTER VISUAL DATA PER USER GUIDE?" to manually enter the number of MOTILE/IMMOTILE sperm seen on the visualization system.
- Press **ENTER** to continue.
- Take the same testing capillary and insert it into the visualization (upper) compartment.
- Set the magnification to x300 (Full zoom out).
- Press **ENTER** to continue.
- "Scan" the depth of the capillary by slightly turning the visualization focus knob (10 fields can be visualized) and enter the total **# MOTILE/IMMOTILE SPERM cells** visualized in all 10 fields.
- The SQA-V will automatically report the GREATER # of cells found by the Automated or Visualization system.
- Press **ENTER** and the test results screen will be displayed.
- Leave the testing capillary in the visualization chamber and transfer the test results to V-Sperm to capture and attach a video clip of the sample in the patient's record.
- If the SQA-V reports > 30 motile spermatozoa, a screen will indicate that a NORMAL TEST should be run instead of a POSTVASECTOMY test.
- > 30 motile spermatozoa is equivalent to MSC > 2M/ml.

<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="background-color: black; color: white; padding: 2px 10px; font-weight: bold;">TESTING</div> <div style="border: 1px solid black; width: 50px; height: 20px;"></div> </div>																	
<p>DO NOT MOVE CAPILLARY OR OPERATE DEVICE DURING TESTING</p>																	
<p>THIS TEST TAKES APPROX. 5 MINUTES</p>																	
<p style="text-align: center;">POSTVASECTOMY</p> <p># SPERM/SCAN: # SPERM/SAMPLE VOL.:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">MOTILE 3</td> <td style="width: 30%;">MOTILE 0.21 M</td> <td style="width: 30%;"></td> <td style="width: 10%;"></td> </tr> </table> <p style="text-align: center;">ENTER VISUAL DATA PER USER GUIDE?</p> <p style="text-align: center;"><b>YES/NO</b></p>		MOTILE 3	MOTILE 0.21 M														
MOTILE 3	MOTILE 0.21 M																
<p>PLEASE INSERT CAPILLARY INTO VISUALIZATION SLOT ADJUST MAGNIFICATION TO x300</p> <p style="margin-top: 10px;">PRESS ENTER</p>																	
<p style="text-align: center;">TURN FOCUS KNOB AND SCAN THROUGH ENTIRE CAPILLARY DEPTH TO COUNT MOTILE AND IMMOTILE SPERM</p> <p style="text-align: center;">PLEASE ENTER:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;"># MOTILE SPERM</td> <td style="width: 40%;">3</td> </tr> <tr> <td># IMMOTILE SPERM</td> <td>8</td> </tr> </table>		# MOTILE SPERM	3	# IMMOTILE SPERM	8												
# MOTILE SPERM	3																
# IMMOTILE SPERM	8																
<p style="text-align: center;">POSTVASECTOMY</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;"># SPERM/SCAN:</td> <td style="width: 30%;"># SPERM/SAMPLE VOL.:</td> <td style="width: 30%;"></td> <td style="width: 10%;"></td> </tr> <tr> <td>MOTILE 3</td> <td>MOTILE</td> <td>0.21 M</td> <td></td> </tr> <tr> <td>IMMOTILE 8</td> <td>IMMOTILE</td> <td>0.53 M</td> <td></td> </tr> <tr> <td>TOTAL 11</td> <td>TOTAL</td> <td>0.74 M</td> <td></td> </tr> </table>		# SPERM/SCAN:	# SPERM/SAMPLE VOL.:			MOTILE 3	MOTILE	0.21 M		IMMOTILE 8	IMMOTILE	0.53 M		TOTAL 11	TOTAL	0.74 M	
# SPERM/SCAN:	# SPERM/SAMPLE VOL.:																
MOTILE 3	MOTILE	0.21 M															
IMMOTILE 8	IMMOTILE	0.53 M															
TOTAL 11	TOTAL	0.74 M															
<p style="text-align: center;">POSTVASECTOMY</p> <p style="text-align: center;"># SPERM/SCAN:</p> <p style="text-align: center;">MOTILE &gt; 30</p> <p style="text-align: center; margin-top: 10px;">PLEASE RE-RUN AS A NORMAL TEST</p>																	

## Control Set-Up and Testing

### Please note:

When a new control lot is used, the control default settings must be changed prior to initiating a test.

Refer to section(s):

Set-up: Assayed Control and

Set-up: Non Assayed material

## SECTION 6: Controls

External quality control samples (CONTROLS) are run on the RUN CONTROLS mode from the MAIN MENU of the SQA-V. Commercially available latex beads or stabilized sperm can be run as non-assayed controls. QwikCheck™ beads produced by Medical Electronic Systems are assayed for the SQA-V. It is recommended that controls be run daily or based upon laboratory protocols.

Control media is aspirated into the testing capillary and run in the same manner as a normal volume specimen in the testing compartment of the SQA-V.

For each **new lot** of controls, SQA-V system defaults need to be set-up/updated through V-Sperm GOLD prior to running a test. To run an assayed control use the information for Target Value and +/- Range provided on the product labeling. To run a non-assayed control, the Target Value and +/- range must be established by the laboratory. Follow instructions below to **set-up** an assayed or non-assayed material. The testing process is the same.

### Set-Up: Assayed Control

Each time a new lot of an assayed control is to be run, the user must set-up/update the CONTROL settings through V-Sperm GOLD as described below. Previous settings (defaults) will remain in place until updated.

- Step 1:** From the SQA-V **MAIN MENU** select **SERVICE > SERVICE DATA**
- Step 2:** Make sure the SQA-V is connected to the PC via the RS232 communication cable.
- Step 3:** Activate the V-Sperm GOLD on the PC and select: **SET-UP > SQA-V > SQA-V Defaults** and press **CONTINUE**.
- Step 4:** The set-up screen below will be activated in V-Sperm GOLD on the PC:

The screenshot shows the SQA-V Set-Up screen with the following sections:

- System:**
  - Choose date format: ☒ Europe (DD/MM/YY), ☐ USA (MM/DD/YY)
  - SQA-V Date: Enter local date 19/11/2015
  - Morph. Criteria: ☒ WHO 3rd, ☐ WHO 4th
  - Conc./Chamber Standard: ☐ 1, ☒ 2
  - Printing Options: ☒ Automatically print all test results, ☒ Automatically print Self Test Report on Start Up
  - Printer Type: ☐ Thermal, ☒ Ink
  - LES: ☐ 1 (US), ☒ 2 (ROW)
- Control:**
  - Control Media: ☒ Latex Beads, ☐ Stabilized Sperm
  - Level 1:**

Lot #	1
Exp. Date	11/15
Target Value	30
+/- Range	5
  - Level 2:**

Lot #	2
Exp. Date	11/15
Target Value	20
+/- Range	3
  - Negative Control:**

Lot #	3
Exp. Date	11/15
Target Value	0.0
+/- Range	0.0

Buttons at the bottom: Report, Apply, Cancel

### Please note:

Level 1, 2, and NEGATIVE control set-up screen from V-Sperm GOLD.

The NEGATIVE control may also be labeled Level 3 control on the SQA-V.

For the SQA-V to work properly the CONTROLS must have set-up data inserted. If control material is not available enter current date in the EXP Date field and zeros in all other fields.

- Step 5:** Select the type of control (Latex Beads or Stabilized Sperm)
- Step 6:** Enter the following information from the box labeling:
  - **LOT#** - number identifying the control media lot.
  - **EXP. DATE** - control expiration date (MM = month, YY = year).
  - **TARGET VALUE and +/- Range** - manufacturer's "Target Value and +/- Range" for the SQA-V Automated System.
  - **NEGATIVE** control target values and +/- ranges are pre-set to 0.0
- Step 7:** To save settings: Press **APPLY**. The set-up may take two minutes.

**Please note:**

To run 10 replicates:  
After each completed test, remove the capillary and initiate the CONTROL test again using the same capillary.

**Running Controls in the SQA-V**

**Set-Up: Non-Assayed Material** (This is also the set-up procedure for sperm concentration proficiency challenge)

Follow the same **Steps 1-5** for "Set-up: Assayed Control" above.

**Step 6:** Enter the following information from the product labeling

- **LOT#** - number identifying the control media lot.
- **EXP. DATE** - control media expiration date (MM=month, YY=year).

**Step 7:** Enter the **TARGET VALUE and +/- Range for Level 1 and Level 2:**

- Enter 00 for the target value
- Enter 0.0 for the +/- range
- NEGATIVE control target value and +/- range is pre-set to 0.0

**Step 8:** Save settings: Press **APPLY**. The set-up takes about two minutes.

**Step 9:** Establish the target value and +/- range for each level:

- Fill a testing capillary and run 10 replicates following the instructions below "Control Testing."
- Calculate the mean target value. Based on laboratory protocols determine the +/- range (Example: 2SD).
- Follow steps 1-7 of "Set-Up: Assayed Control" to update the target value and +/- range for the control.

**CONTROL Testing**

- Select **RUN CONTROLS** from the **MAIN MENU** of the SQA-V.
- The Control defaults have already been set-up in V-Sperm.
- Select the **CONTROL LEVEL:** #1, #2 or NEGATIVE (LEVEL #3) that is being tested.
- Press **ENTER** to continue.
- Controls are run in exactly the same manner as a normal semen sample.
- Using control media, follow the same procedure for filling an SQA-V testing capillary with a NORMAL volume sample.
- Testing will begin automatically.
- Control test results will be displayed on the SQA-V screen.
- LOW, HIGH or NORM. will be displayed based on the testing outcomes vs. target value and +/- range.
- Test results will automatically be saved and printed.

MAIN MENU

TEST NEW PATIENT  
**RUN CONTROLS**  
SERVICE

CONTROL LATEX BEADS  
SELECT:  
CONTROL LEVEL:  
**LEVEL #1**/LEVEL #2/NEGATIVE CONTROL

PRESS ENTER TO CONTINUE

CONTROL: LATEX BEADS, LEVEL #1

FILL, CLEAN AND WIPE CAPILLARY  
INSERT IN CHAMBER  
TESTING WILL BEGIN  
AUTOMATICALLY

CONTROL TEST RESULTS

DATE 01/12/06 DD/MM/YY TIME 15:09:08  
LEVEL #1 LOT# 11223344556677889900  
EXP. DATE 04/09 MM/YY  
TYPE: LATEX BEADS  
TARGET VALUE: 45.0 +/- 6.3 M/ml  
CONC. RESULTS: 45.4 M/ml NORM.  
ACCEPTABLE RANGE: 38.7 – 51.3 M/ml

## Electronic Self-Test and Auto Calibration

**The SQA-V automatically runs a series of tests to check calibration settings and the internal operating system. Tests are run when the system is turned on and prior to testing a sample.**

### Start-up:

- **Stabilization and auto calibration:** Checks system stability and reference ranges. The system sensors are analyzed for several minutes to insure that the values are within a very narrow acceptable range. Once the system is stable for 30 seconds it will pass stabilization and auto calibration. The system will fail if it is not stable for at least 30 seconds and a warning message will be displayed.
- **System noise:** Measures the electronic noise level of the system to insure effective measurement of electronic signals.
- **Self-test:** The system produces electronic signals that simulate motility and concentration measurements in order to check the performance of the system and verify that the calibration settings are consistent with the factory specifications. The SQA-V will report failures (see section on error and warning messages) and "freeze" the system if the system is not within the established self-test ranges.

### Prior to testing a sample:

- **Auto calibration verification:** Reference values are read again. The electronic parameters of the concentration and motility channels are measured (without a testing capillary).
- **System noise:** Measures the electronic noise level of the system to insure effective measurement of electronic signals. Prior to running a test, the SQA-V will automatically adjust the noise level thresholds to insure accurate readings.
- **Electronic spikes:** Checks for any measurement points that are out of range electronically. More than three such points will fault the system and a warning message will be displayed.

## Instructions for printing the SQA-V system parameters to prepare for technical support:

How to print a copy of the system parameters FROM THE SQA-V:

- Remove the testing capillary from the system.
- When a FAILED SELF TEST message appears select: **MAIN MENU > SERVICE>PRINT SELF TEST DATA.**
- Press **ENTER** to generate a report.

How to view/print a copy of the system parameters FROM V-SPERM GOLD:

- Verify that the SQA-V is connected to the PC and V-Sperm is activated.
- From the SQA-V activate: **MAIN MENU > SERVICE > SERVICE DATA**
- Select the V-Sperm navigation buttons: **UTILITIES>SELF-TEST DATA** and click **CONTINUE.**
- Click on the **PRINT** button to view a Service Data Report.
- Click **PRINT** in the upper left hand corner of the screen to print a report.

- **Refer to the table below. Enter numbers in the "SQA-V Value" column that corresponds to the SQA-V system parameters printout. Compare the values. If the value from the SQA-V is within range mark the "Pass" column. If not, mark the "Fail" column.**

#	Parameter	S/W Ver. 2.48	SQA-V Value	Pass	Fail
1.	Ref 1	150 – 350 mV			
2.	LED Cur 1	5 – 25 mA			
3.	Amplitude	50 – 100 mV			
4.	Zero Level	500 - 525			
5.	Ref 2	2500 – 3500 mV			
6.	LED Cur 2	10 – 32 mA			
7.	CONC. 1	0 – 1 M/ml			
8.	CONC. 2	50-150 M/ml			
9.	CONC. 3	300-600 M/ml			
10.	Count (Service Data, Item #12)	26 - 36			



## Archive

### SECTION 7: Transferring the SQA-V Archive to V-Sperm

The SQA-V automatically saves and prints PATIENT and CONTROL test results when the testing cycle is complete. **To view, navigate, edit and delete records, the test results have to be transferred to V-Sperm** immediately after running a test (on-line transfer) or imported to V-Sperm in a group. The SQA-V can store 500 patient records and 750 control records in two separate archives.

The screens below will be displayed when the PATIENT or CONTROL archive of the SQA-V is almost full:

ARCHIVE ALMOST FULL  
  
TO AVOID POSSIBLE LOSS OF DATA  
DOWNLOAD ARCHIVE TO PC  
  
PRESS ENTER TO CONTINUE

To transfer data to V-Sperm, first connect the SQA-V to the PC and activate the V-Sperm software. There are two options for transferring test results to V-Sperm:

#### IMPORT TEST RESULTS ON-LINE:

- Immediately after saving/printing test results, an option to transfer the results of the test just completed is displayed on the SQA-V.
- Following the screen directions, simply PRESS the "Import Test" main menu navigation button in V-Sperm and the test will automatically be transferred into the V-Sperm data base.

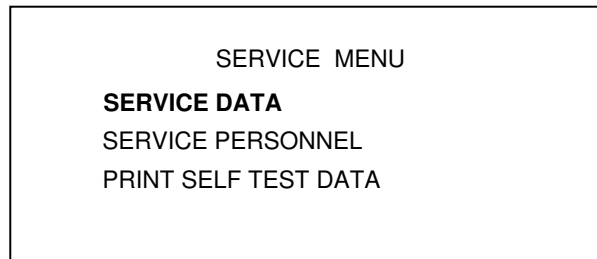
TO TRANSFER TEST RESULTS TO V-SPERM:  
  
PRESS: "IMPORT TEST" BUTTON  
IN V-SPERM

#### IMPORT PATIENT ARCHIVES TO V-SPERM:

- Select the V-Sperm navigation button: **IMPORT/EXPORT**
- Select: **IMPORT DATA > IMPORT ARCHIVE** and press **CONTINUE** and the tests will automatically be transferred
- Select: **YES** on the next screen to delete records from the SQA-V archive.

## SECTION 8: Service Menu

System set-up, maintenance and calibration can be performed from the SERVICE MENU. To activate this screen, press **SERVICE** in the MAIN MENU.



### Service Data

**Communication between the SQA-V and a PC via the RS232 interface is established through the SERVICE DATA screen. System set-up and upgrades are also performed through this screen.**

The SQA-V archive can be transferred to a PC only when this screen is activated.

### Service Personnel

A **code** is required to access SERVICE PERSONNEL. This option allows a qualified service technician to access calibration and maintenance settings.

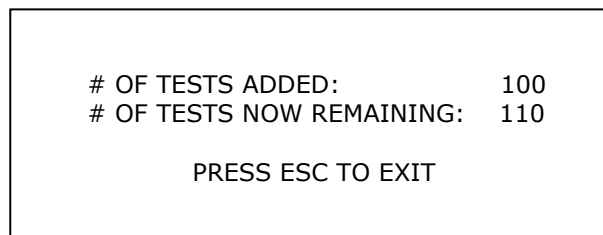
### Print SQA-V Default Settings

The system default settings can be printed from this option.

### Add Test Credit (TC) Codes

From the SQA-V **MAIN MENU** SELECT: **SERVICE > SERVICE DATA** and follow the on screen instructions in the TC-Code Quick Start Guide:

The screen below will be displayed after successfully loading tests:



#### Please note:

Tests are added through the TC Code application that can be downloaded from - [testcreditcode.com](http://testcreditcode.com)

\*\*\* For users implementing the **TC-Code internal feature**, please refer to the TC-Code Quick Start Guide found in the accessory kit or visit [testcreditcode.com](http://testcreditcode.com) for instructions on how to load Test Credits onto your device.

## Introduction

## Operating Instructions

### SECTION 9: Operating the Visualization System (Video Display)

The SQA-V Visualization System with video display (upper screen) is used to view and count sperm cells. The visualization system is a critical "link" to V-Sperm GOLD where enhanced, real time video can be displayed on a PC monitor. The visualization system:

- Accommodates both an SQA-V testing capillary to "scan" through a depth of 300 microns or a standard slide to view samples (20 micron depth).
- Operates via control knobs to set focus, brightness, contrast and color, and via the keypad zoom, illumination, and monitor on/off functions.
- Magnification range: x300 to x500..

#### Standard Slide Preparation:

- Use 10 µl of semen
- Standard slide, 22 mm x 22 mm cover-slip (to insure 20 micron depth)
- Load the prepared, standard slide into the SQA-V slide adaptor.

#### Testing Capillary Preparation:

- Fill the SQA-V testing capillary for either a normal or low volume specimen (see Appendix).

#### Visualization Process:

- The video display will automatically illuminate when the SQA-V is turned on.
- Use monitor **ON/OFF** key on the keypad to independently operate the video display.
- Wait for the self-test to complete (system is disabled at this time).
- To ensure that the visualization system is working properly prior to use:
  - Press the **HIGH ILLUMINATION** key multiple times to ensure a maximum level setting.
  - **To view cells:** Press **ZOOM IN** to maximum magnification (x500).
  - **To count cells:** Press **ZOOM OUT** to minimum magnification (x300).
- Insert semen sample (either capillary or slide) into the visualization chamber.
- Adjust **CONTRAST, COLOR, BRIGHTNESS, FOCUS** and object **ILLUMINATION** controls for optimal image quality.
- Use **ZOOM OUT** (x300) / **ZOOM IN** (x500) to regulate magnification.

#### Counting Cells Using the Visualization Screen:

1. Follow the WHO Manual instructions for semen sample collection and preparation. Thoroughly mix the sample before step #2.
2. Pipette 10uL of the semen sample onto a standard slide and cover with a 22x22 mm coverslip. Prepare a new slide if air bubbles or liquid spillage occurs.
3. Load the slide into the slide adaptor and then insert the slide adaptor into the SQA-V visualization chamber. (Refer to the SQA-V User Guide APPENDIX 3: Using Standard Slides in the Visualization System for details).
4. Press the ZOOM-OUT button on the SQA-V keypad all the way to set the

**Please note:**

The visualization screen grid of the SQA-V is calibrated to a CONC STANDARD default of "1" or Makler/non-dilutional chambers.

Please see the Appendix Section "**Concentration Standard – Counting Chamber**" for details

magnification to x300.

5. Set the: BRIGHTNESS, CONTRAST & COLOR knobs of the video display:
  - a. COLOR knob: Turn clockwise to the end (maximum color),
  - b. CONTRAST: Turn counterclockwise to the end (maximum contrast)
  - c. BRIGHTNESS knob: Turn clockwise from the darkest setting until the background is light (not maximum!).
6. Adjust the focus knob to maximize the image: Turn clockwise all the way. Then turn counterclockwise until a clear image appears on the screen.
7. Go to V-Sperm and click on the **Real Time Video** button. FREEZE the image.
8. The screen of both the SQA-V and the V-Sperm is divided into a grid containing 20-distinct squares (see below).



9. Each spermatozoon seen on the ENTIRE 20-square grid is 1 Million/ml of sperm concentration. FOR EXAMPLE: In the grid above, there are 7 spermatozoa in each cell of the grid. 7 (spermatozoa) X 20 (cells) = 140 M/ml sperm concentration for this sample.
10. To count a minimum of 200 cells (per WHO), turn the silver knob of the slide adaptor and a new field of view will be displayed in the grid.
11. When viewing multiple fields, divide the final count by the number of screens (fields of view) counted. For example, if two of the screens above are counted there would be a total number of 280 sperm cells so the sperm concentration will be:  $280 \div 2 = 140 \text{ M/ml}$ .
12. Refer to table 2.6 of the WHO Manual 4<sup>th</sup> Edition to determine if the duplicate counts are acceptable.

## SECTION 10: Error Messages and Warning Messages

### General Warning:

- The SQA-V equipment's built-in protection for the operator and the environment is **ONLY** operational if the SQA-V is operated properly following the manufacturer's specifications.
- **CAUTION:** There is a risk of explosion or shorting if the SQA-V battery is replaced by an incorrect type. Replacement batteries **MUST** be the same type and manufacturer. Dispose of used batteries in accordance with the manufacturer instructions.
- Environmental condition for storage and transport: Recommended to store the SQA-V at temperatures between 20°C -30°C.
- Following the manufacturer's recommended use, the expected life span of the SQA-V is a minimum of 5 years. The life span can be extended when utilizing the manufacturer's annual preventative maintenance plan.

### Stabilization Failed:

STABILIZATION FAILED  
TURN OFF MAIN SWITCH ON REAR PANEL  
REACTIVATE UNIT  
IF PROBLEM PERSISTS,  
CALL FOR TECHNICAL SUPPORT

- Ensure there is no testing capillary in the measurement compartment.
- Remove the SQA-V from sources of electronic noise (cell phones, etc.) and vibrations (centrifuge).
- Clean measurement compartment (refer to Appendix).
- Reboot the SQA-V without a testing capillary in the chamber:
  - Turn system **OFF** then back **ON** at the main switch on the rear panel.
  - Press the front panel **ON/OFF** key to begin Auto-Calibration/Stabilization.
- Call technical support if failure recurs.

### Self-test Failed:

FAILED SELF-TEST  
TURN OFF MAIN SWITCH ON REAR PANEL.  
CLEAN OPTICAL CHAMBER.  
REACTIVATE UNIT.  
IF PROBLEM PERSISTS  
CALL FOR TECHNICAL SUPPORT

- Ensure there is no testing capillary in the measurement compartment.
- Remove the SQA-V from sources of electronic noise (cell phones, etc.) and vibrations (centrifuge).
- Clean measurement compartment (refer to Appendix).
- Reboot the SQA-V without a testing capillary in the chamber:
  - Turn the system **OFF** then back **ON** at the main switch on the rear panel.
  - Press the front panel **ON/OFF** key to begin Auto-Calibration/Stabilization.

- Call technical support if this message is displayed again. Prepare for technical support by printing a copy of the SQA-V **SERVICE DATA**:
  - Press the SERVICE key on the SQA-V keypad to activate the **SERVICE MENU** screen.
  - Select: **PRINT SQA-V SELF TEST DATA**.
  - Press **ENTER**

#### Electronic Noise:

ELECTRONIC NOISE.  
TURN OFF MAIN SWITCH ON REAR PANEL.  
EACTIVATE UNIT.  
IF PROBLEM PERSISTS,  
CALL FOR TECHNICAL SUPPORT

- Ensure there is no testing capillary in the measurement compartment.
- Remove SQA-V from sources of electronic noise (cell phones, etc.) and vibrations (centrifuge).
- Clean measurement compartment (refer to Appendix) and after cleaning:
  - Turn the system **OFF** then back **ON** at the main switch on the rear panel.
  - Press the front panel **ON/OFF** key to begin Auto-Calibration and Stabilization.
- From **MAIN** menu: Select **TEST NEW PATIENT** and rerun the test.
- Call technical support if this message is displayed again. Prepare for technical support by printing a copy of the SQA-V **SERVICE DATA**:
  - Press the SERVICE key on the SQA-V keypad to activate the **SERVICE MENU** screen.
  - Select: **PRINT SQA-V SELF TEST DATA**.
  - Press: **ENTER**

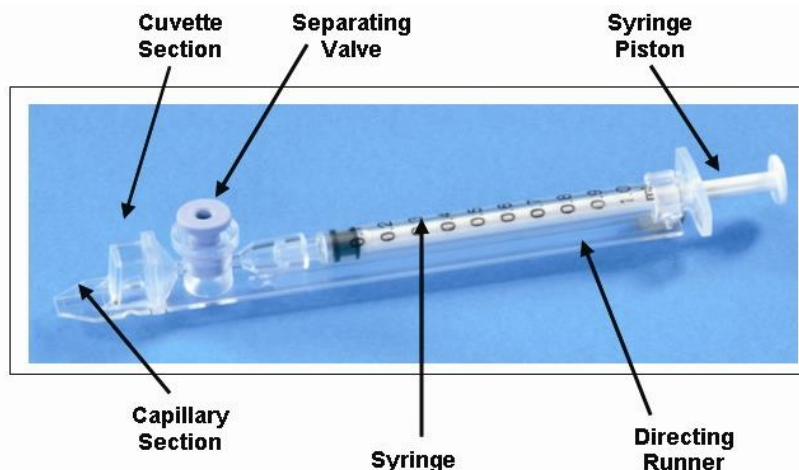
#### Concentration Out of Range

##### Testing Semen Sample:

TEST RESULTS  
OUT OF PHYSIOLOGICAL  
RANGE  
RETEST SAMPLE?  
YES/NO

- A message will appear indicating that the tests results for Sperm Conc and/or MSC are beyond the upper limits of the dynamic range established by the manufacturer for testing. This message will appear if the SQA-V reads:
  - Review sample handling techni SPERM CONC > 500 M/ml or
  - MSC > 450 M/ml
- Re-test the sample in a new SQA-V capillary. If the message appears again, reboot the system.
- Call for technical assistance if problem persists.

## APPENDIX 1: Filling the SQA-V Capillary with a Normal Volume Sample



### Sample size, collection container and preparation:

1. Sample volume should be **at least .5 ml**. If sample volume is less than .5 ml see Appendix 2.
2. Sample container should be **wide-necked and deep enough** to facilitate inserting the capillary into the sample at the bottom of the container.
3. The semen sample must be **completely liquefied and well mixed prior to aspiration**. Gently rotate container to fully mix liquefied specimen.

**WARNING:** Do not shake nor use a pipette to aspirate and dispense specimen in order to mix, otherwise air bubbles will form.



Figure 1

4. **Carefully check that liquefied, fully mixed specimen is free of air bubbles** (or that there is an adequate amount of sample below the air bubbles) before immersing the capillary into the specimen, thus ensuring that no air bubbles will be aspirated into the capillary.

### Filling the capillary:

1. **Push the syringe piston in fully**. Place only thin part of the capillary into the bottom of the sample while angling the sample container at about 45 degrees (Figure 1).
2. Placing two fingers below the piston head **pull the piston back slowly while keeping the tip of the capillary well below the sample level and below any surface bubbles** (Figure 1). Continue to aspirate the sample until it appears in the Luer adaptor.



Figure 2

**NOTE:** Transferring the sample to a standard "tissue culture dish" (3 cm in diameter/1 cm deep) will allow better visual control when filling the capillary as an intermediate step (see Figure 2).



3. Holding the capillary in a vertical position (Figure 3), **visually confirm that the sample has completely filled** the thin section (without a meniscus) and the cuvette section and appears in the Luer adaptor. **Tap on the syringe to make sure there are no air bubbles** in the sample. If, after tapping, some air bubbles appear below the Luer adaptor, dip the capillary into the semen sample again and aspirate a small quantity of semen to draw the air bubbles into the syringe.
4. Quickly (to avoid wicking) and **thoroughly wipe the outer surface of the capillary** - both top and bottom (Figure 4) with a delicate wipe (Kimwipes, etc.). It is important to remove all semen from the exterior of the capillary in order to prevent the SQA-V optical chamber from becoming clogged. Visually confirm that the capillary chambers are still full following the cleaning process. If some of the sample has been depleted (meniscus formed in the thin part of the capillary) fill the capillary part from the cuvette section by slightly pushing in the piston.



**Figure 4**



**Figure 3**

5. Slowly and carefully **push-in the separating valve** until it is level with the plastic (Figure 5). The capillary is now ready to be inserted into one of the SQA-V compartments for testing or viewing.



**Figure 5**

6. **For automated testing push the testing capillary into the lower measurement compartment with the blue stopper down.** Push it in as far as it will go to ensure that the capillary is properly seated in the compartment.
7. **To visualize the specimen, insert the capillary into the visualization compartment with the blue stopper up.**





## APPENDIX 2: Filling the SQA-V Capillary with a Low Volume Sample

### Sample size, collection container and preparation:

1. A sample as small as 20 micro liters can be tested for motility parameters by filling **ONLY** the thin section of the testing capillary (Figure 1).
2. The semen sample must be **completely liquefied and well mixed prior to aspiration**. Gently rotate the container to fully mix the liquefied specimen.  
**WARNING:** Do not shake nor use a pipette to aspirate and dispense specimen in order to mix, otherwise air bubbles will form.
3. **Carefully check that the liquefied, fully mixed specimen is free of air bubbles** (or that there is an adequate amount of sample below the air bubbles) before immersing the capillary into the specimen, thus ensuring that no air bubbles will be aspirated into the capillary.
4. **It is recommended that the sample be withdrawn from a standard "tissue culture dish"** (3 cm in diameter/1 cm deep) to allow for better visual control when filling the capillary.



Figure 2



Figure 1

### Filling the capillary:

1. **Push the syringe piston in fully**. Place only the thin part of the capillary into the bottom of the sample (Figure 1).
2. **Pull the piston back slowly** without withdrawing the capillary from the sample. **Fill only the (thin) capillary chamber** with 20 micro liters of semen (Figure 1). The exact quantity aspirated can be determined by the gradations on the 1 ml syringe. Aspirate the sample until it just appears in the cuvette part while keeping the tip of the capillary well below the sample level and well below the level of any bubbles covering the liquid. Withdraw the capillary tip from the semen sample and visually inspect the capillary to ensure that the sample has completely filled the thin section (no meniscus).
3. Quickly (to avoid wicking) and **thoroughly wipe the outer surface of the capillary** - both top and bottom with a delicate wipe (Kimwipes, etc.). It is important to remove all semen from the exterior of the capillary in order to prevent the SQA-V optical chamber from becoming clogged. Visually confirm that the thin chamber of the capillary is still full of semen after completing the cleaning process. If some of the sample has been depleted push-in the piston slightly until the first drop appears on the capillary tip and then fill the capillary again from the sample container.
4. The separating valve must now be removed. Detach the entire syringe from the hub (Figure 2) and use the syringe tip to firmly **push-out the separating valve** from the underside of the capillary (Figure 3). Completely detach the separating valve (Figure 4). The capillary is now ready to be inserted into the SQA-V.
5. **PLEASE NOTE: Test Low Volume samples as soon as the sample is aspirated into the capillary.**



Figure 3



Figure 4

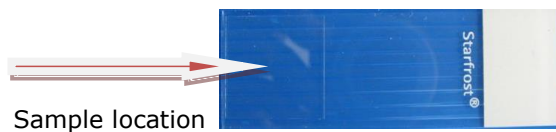
## APPENDIX 3: Using Standard Slides in the Visualization System

### Introduction

The SQA-V has a specially designed slide adaptor that enables the user to use standard slides to view semen samples in the SQA-V visualization compartment. A slide is "seated" in a stable and secure manner as described below and the slide adaptor is inserted into the SQA-V for testing.

### User Instructions

1. The slide adapter is designed for standard laboratory slides that are 76 mm long and 25.6 mm wide. Thickness may vary from 1 mm to 2 mm. The viewing section of the slide must be completely transparent.
2. Center a 10 micro-liter drop of semen at a distance of approximately 12 mm from the edge of the slide and cover with a standard (22 mm x 22 mm) cover-slip. The droplet of semen should be evenly spread across the entire surface area of the cover-slip automatically, without any additional pressure applied to the cover-slip:



3. Carefully place the prepared slide into the slide adapter (with the non-loaded side towards the slide holder):



4. Open the spring loaded slide holder by pressing on its outer edge. Slip the slide into the holder and release the spring:



5. Align the edge of the slide with the distal edge of the slide adapter by turning the silver slide position adjuster as seen below. The slide will now be firmly in place in the slide adapter:



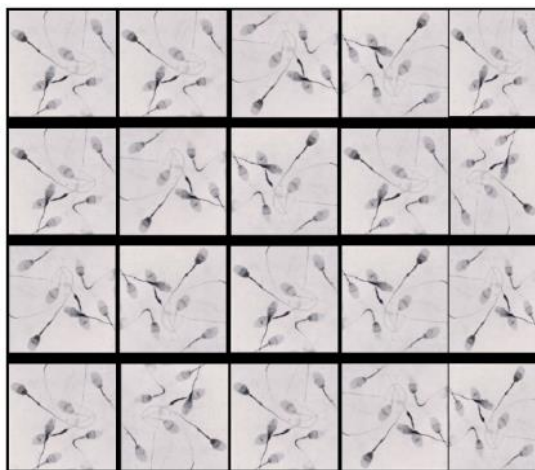
6. Insert the fully loaded slide adapter into the visualization chamber of the SQA-V:



7. Optimize the video image in the usual manner (please see the SECTION 9: Operating the Visualization System) and move to additional fields of view by turning the silver knob of the slide adapter.

## APPENDIX 4: Counting Cells using the SQA-V Visualization System

1. Follow the WHO Manual instructions for semen sample collection and preparation. Thoroughly mix the sample before step #2.
2. Pipette 10uL of the semen sample onto a standard slide and cover with a 22x22 mm cover slip. Prepare a new slide if air bubbles or liquid spillage occurs.
3. Load the slide into the slide adaptor and then insert the slide adaptor into the SQA-V visualization chamber. (Refer to the SQA-V User Guide APPENDIX 3: Using Standard Slides in the Visualization System for details).
4. Press the ZOOM-OUT button on the SQA-V keypad all the way to set the magnification to x300.
5. Set the: BRIGHTNESS, CONTRAST & COLOR knobs of the video display:
  - a. COLOR knob: Turn clockwise to the end (maximum color),
  - b. CONTRAST: Turn counterclockwise to the end (maximum contrast)
  - c. BRIGHTNESS knob: Turn clockwise from the darkest setting until the background is light (not maximum!).
6. Adjust the focus knob to maximize the image: Turn clockwise all the way. Then turn counterclockwise until a clear image appears on the screen.
7. Go to V-Sperm and click on the **Real Time Video** button. FREEZE the image.
8. The screen of both the SQA-V and the V-Sperm is divided into a grid containing 20-distinct squares (see below).



9. Each spermatozoon seen on the ENTIRE 20-square grid is 1 Million/ml of sperm concentration. FOR EXAMPLE: In the grid above, there are 7 spermatozoa in each cell of the grid. 7 (spermatozoa) X 20 (cells) = 140 M/ml sperm concentration for this sample.
10. To count a minimum of 200 cells (per WHO), turn the silver knob of the slide adaptor and a new field of view will be displayed in the grid.
11. When viewing multiple fields, divide the final count by the number of screens (fields of view) counted. For example, if two of the screens above are counted there would be a total number of 280 sperm cells so the sperm concentration will be:  $280 \div 2 = 140$  M/ml.
12. Refer to table 2.6 of the WHO Manual 4<sup>th</sup> Edition to determine if the duplicate counts are acceptable.

## APPENDIX 5: Cleaning the Capillary Compartment

### When to clean: **DAILY (step 1)**, **WEEKLY (step 2)**

- Or if SELF-TEST or any other failure occurs
- Or if System becomes contaminated with semen

### Cleaning kit components:

- Long cleaning brush
- Fibrous material cleaning paddles (single use)
- Sponge-tipped drying paddles (single use)
- Cleaning fluid (single drop dispenser)

**PLEASE NOTE: Cleaning and drying Paddles are for ONE TIME use only!**

### CLEANING: STEP 1 (DAILY)

- Insert the long brush (bristle side down) into the upper portion of the lower chamber of the SQA in the same manner as a testing capillary (Fig 1 and 2).
- Pull the brush out, applying downward pressure to sweep or 'dust off' the optics (you will feel a 'shelf' in the back/top section of the chamber) – (Fig 2 and 3)
- **Monitor the system's "REF. 2" parameter. It should be between 2800 and 3200 mV if possible.**

### CLEANING: STEP 2 (WEEKLY)

1. Use a **Fibrous material** cleaning paddle (fig 4)
  - Moisten with only **ONE** drop of cleaning fluid.
  - Shake off excess fluid.
  - Insert into the measurement compartment fibrous material facing **DOWN ONLY** (fig 5)
  - Move the cleaning paddle in and out three times.
2. Use a sponge-tipped drying paddle into the testing chamber and leave it for 10 – 15 seconds (fig 6).

**NOTE: Do not move this drying paddle in and out**

Fig. 1: Long cleaning brush

Fig. 2: Cleaning lower chamber

Fig. 3: "Dusting off"

Fig. 4: **FIBROUS** cleaning paddle

Fig. 5: Insertion-**Fibrous material facing DOWN**

Fig. 6: Insertion of **drying Paddle**

## APPENDIX 6: Reference Values of Semen Variables

SEMEN PARAMETER	SQA-V TEST NAME	REFERENCE RANGE*	SOURCE
Sperm Concentration (Count)	SPERM CONC.	≥20 M/ml	WHO 4th manual*
Motility (grades a+b+c)	MOTILITY <a+b+c>	-	-
Rapid Progressive Motility (grade a)	RAPID PROG. MOTILITY <a>	≥50% <a+b> or ≥25% <a> only	WHO 4TH manual*
Slow Progressive Motility (grade b)	SLOW PROG. MOTILITY <b>		
Non Progressive Motility (grade c)	NONPROG. MOTILITY <c>	-	-
Immotility (grade d)	IMMOTILITY <d>	-	-
Morphology (% Normal Forms:WHO 3 <sup>rd</sup> )	MORPH. NORM FORMS WHO 3rd	≥30%	WHO 3rd manual*
Morphology (% Normal Forms:WHO 4 <sup>th</sup> )	MORPH. NORM WHO 4 <sup>th</sup> Strict	≥15%? (Under investigation)	WHO 4 <sup>th</sup> manual*
Motile Sperm Concentration	MSC	-	-
Progressively Motile Sperm Concentration (grade a)	PMSC <a>	≥10 M/ml <a+b> or ≥ 5 M/ml <a> only	MES Ltd.*
Progressively Motile Sperm Concentration (grade b)	PMSC <b>		
Functional Sperm Concentration	FSC	≥7 M/ml (WHO 3 <sup>rd</sup> ) ≥3 M/ml (WHO 4 <sup>th</sup> )	MES Ltd.*
Velocity (Curvilinear velocity – VCL)	VELOCITY	≥5 mic./sec.	MES Ltd.*
Sperm Motility Index	SMI	≥80	MES Ltd.*
Total Sperm Number	SPERM #	≥40 M/ml	WHO 4TH manual*
Total Motile Sperm	MOT. SPERM	-	-
Total Progressively Motile Sperm	PROG. SPERM	≥20 M	MES Ltd.*
Total Functional Sperm	FUNC. SPERM	≥14 M (WHO 3 <sup>rd</sup> ) ≥6 M (WHO 4 <sup>th</sup> )	MES Ltd.*

\*Each laboratory should establish its own reference ranges for semen parameters. The ranges established above are based on WHO 3<sup>rd</sup> or 4<sup>th</sup> standards or MES Ltd. (for proprietary semen parameters)



## APPENDIX 7: Product Performance Data

### Abbreviations

TSC:	Sperm Concentration (Count)	MSC:	Motile Sperm Concentration
PMSC:	Progressive Motile Sperm Concentration	Morph Norm Forms:	Morphologically Normal Forms
OD:	Optical Density	MV:	Millivolt

### Performance Data Summary

The performance the SQA-V is summarized in the text, tables and graphs below. All values concerning sperm concentration measurements are expressed as  $10^6$  sperm cells per milliliter (M/ml). Motility and morphology values are expressed as a percent (%). Unless otherwise noted all testing was performed using human donor semen samples.

### Calibration:

Each SQA-V is biologically calibrated against two reference systems at Medical Electronic System's laboratory.

### Dynamic Range:

Sample Type	Test Mode	Sperm Conc. M/ml	Motility %	Morph %	MSC M/ml	PMSC M/ml	#Sperm Cells/field
Fresh	Normal	2-400	0-100	0-100	.2-400	0-400	-
Washed	Normal	2-200+	0-100	0-100	.2-200+	0-200+	-
Frozen	Normal	-	-	-	.2-200+	0-200+	-
All Types	Post-Vasectomy	-	-	-	0-2	-	0-30

### Precision

### Precision and Accuracy Established Against a Known Target (Latex beads)

**Background:** The precision and accuracy of the SQA-V was compared to a known target value using latex beads (Accu-beads®).

Latex beads are used as a quality control product to validate the accuracy of sperm counting methods for two known levels of concentration. In accordance with CLIA regulations such a control is used to demonstrate operator proficiency using the microscope and for validation of automated sperm counting methods. The latex beads were run in the SQA-V in the same manner semen samples are run on the system.

### Limitations of method:

Latex beads cannot:

- Measure sperm motility or morphology
- Correct for inaccurate chamber depths or technician errors

### Method comparison:

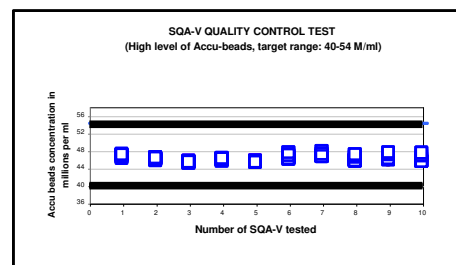
A total of 320 latex bead samples were tested on ten SQA-V systems (32 samples/SQA-V). SQA-V concentration readings were compared to established target values +/- acceptable range.

### Latex beads established target values +/- ranges (Hemocytometer):

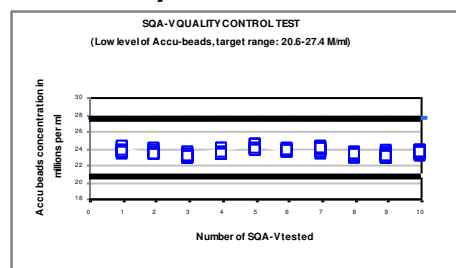
- Vial #1: 47 +/- 7.0 M/ml
- Vial #2: 24 +/- 3.4 M/ml

SQA-V	Accu-beads®	CV, %
Intra-device Variability	<b>High 47± 7.0 M/ml</b>	≤ 0.01
	Low 24 ± 3.4 M/ml	≤ 0.01
Inter-device Variability	<b>High 47± 7.0 M/ml</b>	≤ 2.00
	Low 24 ± 3.4 M/ml	≤ 2.50

### Accuracy: High Level Control



### Accuracy: Low Level Control



## Precision and accuracy established in clinical trials using human semen samples

### Clinical claims:

#### Specificity

- Concentration: 85%
- Motility: 80%
- Morph. Norm Forms (WHO 3<sup>rd</sup>): 65%
- Morph. Norm Forms (WHO 4<sup>th</sup>): 60%
- Postvasectomy: 90% of motile cells detected

#### Sensitivity

- Concentration: 90%
- Motility: 85%
- Morph. Norm Forms (WHO 3<sup>rd</sup>): 85%
- Morph. Norm Forms (WHO 4<sup>th</sup>): 65%

#### Correlation to Manual Method

- Concentration: 0.9
- Motility: 0.85
- Morph. Norm Forms (WHO 3<sup>rd</sup>): 0.65
- Morph. Norm Forms (WHO 4<sup>th</sup> strict): 0.45

#### Linearity

Linear Sperm Concentration throughout the SQA-V dynamic range of 2M/ml to 400M/ml

- Squared regression coefficient of Dilution Curve  $R^2 \geq 0.9$ .
- Averaged coefficient of variation CV of measured vs. expected sperm concentration  $\leq 20\%$ .

*Note: Claims are less than actual correlations noted (see tables 1 and 2)*

**Background:** The SQA-V concentration, motility and morphology readings were compared to standard microscopic readings using a Makler or Neubauer chamber based on WHO 4TH standards and MES protocols. Three independent clinical trials were conducted at three sites. A total of 539 human semen samples were analyzed as described below: 342 samples were of low quality and were tested in the Postvasectomy mode.

#Samples	Fresh	Washed	Frozen	High Sensitivity
539	125	42	30	342

**Precision (Table #3):** Duplicate samples were assessed using 2 SQA-V's. The coefficients of variation (CV) characterizing precision were calculated for Sperm Concentration and Motility and were below 6%.

### Specificity:

- To achieve analytical specificity a specific wave length of light which is maximally absorbed by sperm cells and minimally absorbed by other cells and seminal plasma is used.
- Low noise and high electronic resolution hardware components and compensation circuits ensure that analytical specificity is optimized.

### Limitations of clinical specificity:

- Highly viscous samples cannot be read accurately.
- Sample size must be  $>0.7\text{ml}$  for fully automated tests.
- % Normal Morphology is a parameter derived from the correlation between morphology and progressive motility. This is not a direct measurement.
- Results obtained from the use of the SQA-V visualization system may be affected by the subjectivity of the operator.
- Dynamic range limitation as stated above.

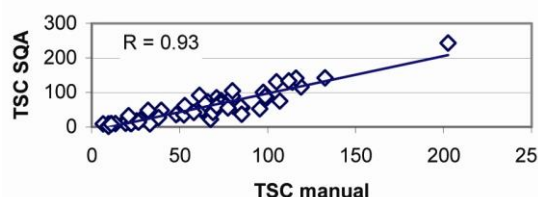
**Table 1: Sensitivity/Specificity**

SQA-V vs. Microscope	Sensitivity	Specificity
<b>Trial #1:</b>		
Concentration	100%	95%
Motility	97%	85%
Morph Norm Forms (WHO 3 <sup>rd</sup> )	94%	75%
<b>Trial #2:</b>		
Concentration	94%	90%
Motility	87%	90%
Morph Norm Forms (WHO 4 <sup>th</sup> )	69%	70%
<b>Trial #3: High Sensitivity* (see table#4)</b>		
Motile Sperm Cells	95%	95%
Immotile Sperm Cells	99%	100%

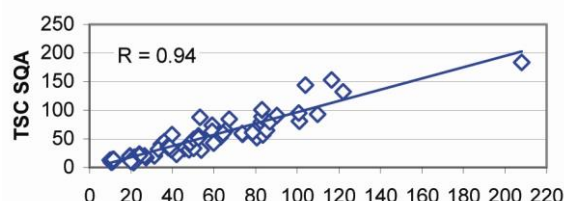
**Table #2: Correlation to Manual Method**

Parameters	Correlation Coefficients	
	Trial #1	Trial #2
Sperm Concentration M/ml	0.93	0.94
Motility %	0.86	0.87
Morphology WHO 3 <sup>rd</sup>	0.66	NA
Morphology WHO 4 <sup>th</sup>	NA	0.49
MSC	NA	0.79

**1st clinical trial - TSC correlation**



**2nd clinical trial- TSC correlation**



### Limitations of method:

Samples were assessed by different operators using a microscope and the SQA-V. Inter-operator subjectivity may have affected the results of the study.

### Method comparison:

- SQA-V was compared to the microscope based on WHO 4TH guidelines.
- Sensitivity and specificity were calculated using ROC curves. WHO 4TH guidelines were used to establish cutoffs for reference values (see table #1).
- The POSTVASECTOMY test compared three assessment methods:
  - Microscope (standard slide: X400; 10 fields of view)
  - SQA-V (SQA-V + SQA-V visualization)
  - SQA-V visualization system (see table #2).
- Immotile cells were analyzed by use of the SQA-V visualization system.
- 218 of the 342 semen specimens contained motile cells and were used as the basis for the method comparison (Table #4).

**Table #3: Precision**

Parameter	Range	Method	
		SQA-V CV%	Microscope CV%
Sperm Concentration M/ml	Entire Range	3.1	6.1
	5-40	5.2	5.9
	41-80	2.1	5.5
	>80	2.5	3.2
Motility %	Entire Range	5.1	7.2
	10-50	7.6	10.3
	51-55	1.5	3.4
	>55	6.0	4.1

**Table #4: Percentage Motile Cells Detected**

Method Comparison of 218 Samples with Motile Cells	# Samples Motile Sperm Detected	% Samples Motile Sperm Detected
SQA-V Automated System and Visualization System	207	95%
Visualization System only	193	89%
Microscope only	161	74%

### SQA-V Linearity

#### Clinical claims:

- Linear Sperm Concentration throughout the SQA-V dynamic range of 2M/ml to 400M/ml:
  - Squared regression coefficient of Dilution Curve  $R^2 \geq 0.9$ .
  - Averaged coefficient of variation CV of measured vs. expected sperm concentration  $\leq 20\%$ .

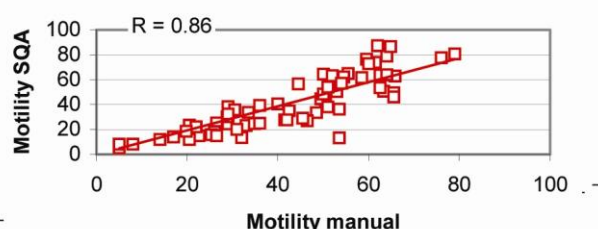
**Goal:** To demonstrate the ability of the SQA-V to accurately report sperm concentration along the dynamic range of the system using sequentially diluted human semen samples.

**Methodology:** 4 fresh human semen samples were pooled, divided into two aliquots and centrifuged at 600g for 15 minutes. The seminal plasma was decanted and the pellets were re-suspended in washing media: DPBS & HEPESHTF. Sequential dilutions were run in 4 SQA-V systems.

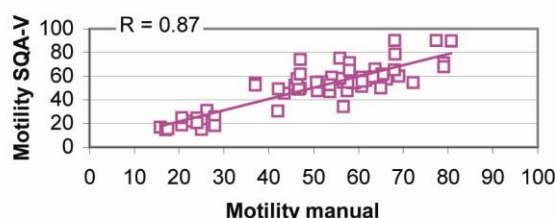
#### Limitations of method:

- Dilution errors contribute to the accuracy of the linearity test results.
- Sample handling errors such as the introduction of bubbles into the testing capillary can cause inaccurate readings.

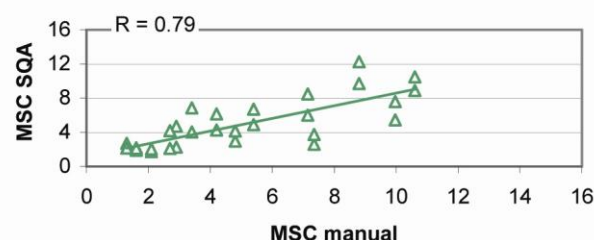
### 1st clinical trial- Motility correlation



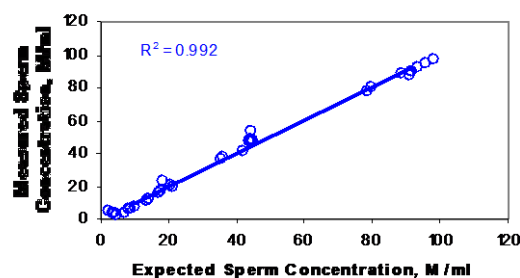
### 2nd clinical trial - Motility correlation



### 2nd clinical trial - MSC correlation



### SQA-V DILUTION CURVE USING SEMEN DILUTED WITH DPBS & HEPES SOLUTION



#### Results:

- Squared regression coefficient  $R^2$  of Dilution Curve (trend line) was found to be 0.992 (note graph displaying results of four SQA-V's and DPBS and HEPES dilution media).
- Averaged coefficient of variation CV of measured vs. expected sperm concentration was 10%.



## APPENDIX 8: Concentration Standard – Counting Chambers

A number of commercially available counting chambers are used in laboratories for manually counting sperm cells. These chambers vary by depth and one type requires a diluted sample. It has been clinically established that counts vary by approximately 30% depending on the chamber used.

The SQA-V permits the user to select the type of chamber the laboratory has implemented as a standard for manual semen analysis. Once the concentration standard (CONC. STANDARD) has been selected the SQA-V will automatically run semen samples based on that standard.

### SQA-V Set-Up:

- From the SQA-V Main Menu go to **Service > Service Data**
- Log into V-Sperm and go to **Set-Up > SQA-V > SQA-V Defaults > Continue**
- **Select** the **CONC. (concentration) STANDARD** based on the options presented in the table below for standard 1 or standard 2.
  - CONC. STANDARD #1
  - CONC. STANDARD #2

### Commercially available counting chambers are divided into two unique groups:

- **Standard #1:** 10-20 micron depth and do not require sample dilution.
- **Standard #2:** 100 micron depth (haemocytometers) that require sample dilution.

The table below classifies some commercially available chambers:

CHAMBER STANDARD #1	CHAMBER STANDARD #2
Makler	Beurker-Tuek
Micro-Cell	Buerker
Fixed Cover slip disposable chambers	Fuchs-Rosenthal
	Fuchs-Rosenthal (modified)
	Improved Neubauer
	Neubauer
	Malassez
	Thoma
	Thoma Modified

## Appendix 9: Post-vasectomy Protocol

The SQA-V runs a five minute POSTVASECTOMY test that can detect the presence of a very small number of motile cells. Once the automated test has been performed the user is given the option to follow the POSTVASECTOMY protocol outlined below (also refer to the Appendix section of this guide) and "scan" the testing capillary in the SQA-V visualization system.

By scanning through the depth of the testing capillary the user is able to identify and readily count immotile cells and visually confirm automated test results. Clinical studies positively demonstrated that by incorporating both the SQA-V automated AND the visualization system in the testing protocol, a very high level of accuracy is obtained for identifying motile and non-motile cells in POSTVASECTOMY samples.

In order to obtain similar levels of accuracy it is imperative that the user strictly follow the manufacturer's protocol outlined below. Additionally, once the testing cycle is complete, the user has an opportunity to document test results by capturing and archiving a video clip of the postvasectomy specimen using V-Sperm™ software.

*This test is highly sensitive to any movement and the SQA-V and the testing capillary should not be disturbed in any way during the 5 minute testing cycle.*

- Typically, there are minimal cells in a POSTVASECTOMY specimen. Therefore, in order to concentrate the cells the specimen must be centrifuged and the pellet re-suspend prior to testing. (WHO 4TH recommends centrifuging specimens with counts < 1-2/field in order to concentrate the specimen).
- Centrifuge the specimen @ 600g for 15 minutes (WHO 4TH)
- Decant the supernatant and re-suspend the pellet in 0.8 ml seminal plasma (can be supplemented with Earl's Buffer).
- Fill both sections of the SQA-V testing capillary by filling BOTH sections (for stability during the 9 minute test).
- If the specimen volume is not adequate to fill both sections, add Earls Buffer.
- Follow the user guide for instructions on running a POSTVASECTOMY sample.
- Run the automated 5 minute test for motility parameters
- Remove the capillary and insert it into the visualization system and "scan" ten fields of the SQA-V capillary following the user guide instructions.
- Enter the number of motile and immotile sperm cells visualized.
- The final test results will report the greater number of cells found in the automated or visualization test.
- Leave the testing capillary in the visualization system.
- Save the test to the SQA-V archive and import it to the V-Sperm GOLD software.
- Following the V-Sperm user guide instructions, import the test into the V-Sperm data base and attach a live VIDEO clip to the patient's test record for documentation purposes.
- *NOTE: If the SQA-V is reporting > 30 motile spermatozoa, a screen will indicate that a NORMAL TEST should be run instead of POSTVASECTOMY > 30 motile spermatozoa is equivalent to MSC > 2M/ml.*

## APPENDIX 10: SERVICE REPORT

### SQA-V SERVICE SUPPORT Parameter Report

Device number: \_\_\_\_\_ SQA-V Software Version: \_\_\_\_\_ Date: \_\_\_\_\_

Instruct the user to run a SERVICE report. For version 2.48 from the MAIN MENU select: **SERVICE > PRINT SELF TEST DATA.**

#### **Calibration parameters:**

Fill-in the USER REPORT column with the calibration parameters found in the INTERNAL DATA SECTION of the SERVICE DATA REPORT run on the "defective" SQA-V. Contact MES for the initial calibration parameters. These parameters should not have changed.

Parameter	Service Report Item #	User Report	MES Report	Comments
CONTR.REF1	#1			
OD AMPLIF.	#13			
MSC AMPLIF	#8			
OD VALUE	#15			
OD CORR	#16			
LB OD AMP	#18			
CONTR. Z.L*	#11			

\*CONTR. Z.L. can be adjusted in the field by a MES trained service technician

#### **Algorithm parameters**

Fill-in the User Report values for the following algorithm parameters found in the SERVICE DATA REPORT. The SQA-V algorithm settings are defined and should not have changed.

Parameter	Service Report Item #	User Report	MES Settings	Comments
MIN.SP.HEIGHT	#2		5	
MIN.SP.WIDTH	#9		10	
MAX.SP.WIDTH	#3		150	
NOISE THRESH	#10		6	
SMI THRESH	#4		28	

### **Self Test Parameters:**

Fill-in the SQA-V SELF TEST PARAMETERS from the SELF TEST printout in V-Sperm:

- The SQA-V must be connected to the PC and V-Sperm activated.
- From the **SERVICE>SERVICE DATA** screen of the SQA-V:
  - Go to the V-Sperm navigation buttons: **UTILITIES>SELF TEST DATA**
  - Select **PRINT**
  - Verify that the parameters listed below fall within the established range
  - Highlight the discrepancies and report to MES

<i>Parameter</i>	<b>S/W Ver. 2.48 Criteria</b>	<b>SQA-V Self-Test Parameters</b>	
Ref. 1	150 – 350 mV		
<b>LED Current 1</b>	<b>5 – 25 mA</b>		Original value
Amplitude	50 – 100 mV		
Count (#12)	26 – 36		
Zero Level	500 – 525		
Ref. 2	2500 – 3500		
<b>LED Current 2</b>	<b>10 – 32 mA</b>		Original value
TSC 1 or CONC 1	0 – 1 M/ml		
TSC 2 or CONC 2	50 – 150 M/ml		
TSC 3 or CONC 3	300 – 600 M/ml		

## APPENDIX 11: SQA-V Reports

### Semen Analysis Report

#### SEMEN ANALYS. REPORT

SQA-V SN 1867  
 SW VER. 02.48.114  
 TEST DATE 14/01/24  
 TEST TIME 13:08  
 PRINT DATE 14/01/24  
 PRINT TIME 13:10

#### PATIENT DATA

ID 1485263  
 BIRTH DATE 14/01/24  
 ABSTINENCE 15 DAYS

#### SAMPLE DATA

ACCESSION #: 45932  
 COLLECTED 14/01/24 12:59  
 RECEIVED 14/01/24 15:00  
 TYPE FRESH  
 VOLUME 5ml  
 WBC CONC. < 1M/ml  
 PH 5  
 APPEARANCE NORM.  
 LIQUEFACTION NORM.  
 VISCOSITY NORM.

#### TEST RESULTS

CONC. 66.6M/ml  
 MOTILITY 40.7%  
 PROGRESSIVE MOTILITY  
 RAPID <a> 15.9%  
 SLOW <b> 15.6%  
 NONPROG. <c> 9.0%  
 IMMOT. <d> 59.3%  
 MORPH. NORM. FORMS  
 <WHO 3rd> 32.3%  
 MSC 27.1M/ml  
 PMSC <a> 10.6M/ml  
 PMSC <b> 10.5M/ml  
 FSC 11.4M/ml  
 VELOCITY 37mic/sec  
 SMI 95

#### TOTALS PER VOLUME

SPERM # 333.0M  
 MOTILE SPERM 135.7M  
 PROG. SPERM 105.4M  
 FUNC. SPERM 57.1M

#### SYSTEM DATA

5. 11.49 7. 0.781 12. 233  
 AM 14792 19. 2 Conc. Std. 2  
 WHO 3

### Service Data Report

#### SERVICE DATA REPORT

SQA-V SN 1988  
 SW VER. 02.48.107  
 PRINT DATE 01/07/19  
 PRINT TIME 11:26

#### INTERNAL DATA

REF. 1 215mV  
 LED CUR. 1 8mA  
 AMPLITUDE 0mV  
 SMI 0  
 ZERO LEVEL 513  
 REF. 2 2985mV  
 LED CUR. 2 19mA  
 CONC. 1 0.0M/ml  
 CONC. 2 103.0M/ml  
 CONC. 3 422.0M/ml

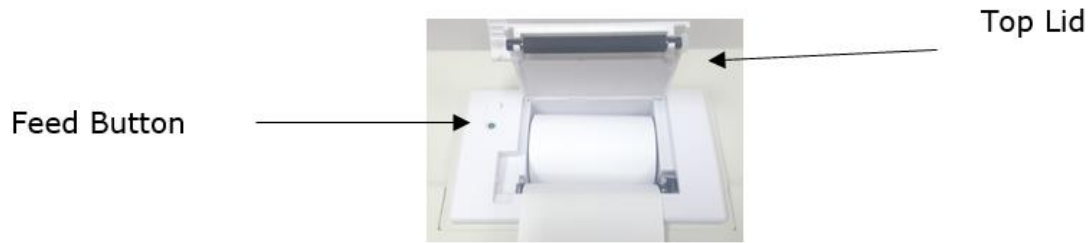
#### ALGORITHM

MSC 0.2M/ml  
 CONC. 188.9M/ml  
 N.MORPH. %  
 VELOCITY mic/sec  
 NUMBER SPIKE 0  
 AREA 0.0  
 MOTILITY 0.0%  
 FSC M/ml  
 AVG. WIDTH 0




#### SERVICE DATA

1. 15  
 2. 5  
 3. 150  
 4. 28  
 5. 0.00  
 6. 513  
 7. 1.186  
 8. 100  
 9. 10  
 10. 6  
 11. 90  
 12. 0  
 13. 100  
 14. 11.1  
 15. 1.70  
 16. 100  
 17. 1  
 18. 1000  
 19. 1

## APPENDIX 12: Thermal Printer Paper Replacement



**Fig. 1 - Thermal Printer**

1. Lift the Lid Lever. The Top Lid will open (Fig. 1).		
2. Load the paper in the printer in the direction shown in Fig. 2	 Fig. 2	 Fig. 3
3. Make sure the end of the paper is extended beyond the printer as shown in Fig. 3		
4. Close the lid of the printer as shown in Fig. 4	 Fig. 4	
5. Turn on the device and press the FEED BUTTON to make sure that the paper comes out properly.		

### PLEASE NOTE:

- Before installing paper, tear off the edge of the paper that was glued.
- Before inserting the paper roll, make sure there are no objects inside the printer.
- Use only M.E.S. supplied paper – standard rolls are too large for this printer and will damage it.
- Do not print when there is no paper in printer or during loading.

## APPENDIX 13: Warranty



### Sperm Quality Analyzer

#### SQA-V

#### Warranty

Medical Electronic Systems, Ltd. ("MES") warrants that the Sperm Quality Analyzer (the "SQA") will be free from defects in workmanship and materials for a period of twelve (12) months from date of purchase. During the warranty period, if the SQA is shown to MES's reasonable satisfaction to be defective, MES shall, at its option, repair such an SQA without charge for parts or labor. The foregoing remedy shall be purchaser's sole and exclusive remedy under this warranty. In the event (i) purchaser makes any modifications or alterations to the SQA or (ii) the SQA is used, operated, opened or serviced other than as directed by MES or is damaged as a result of use, operation or servicing other than as directed by MES, the foregoing warranties shall be void and of no further force or effect. EXCEPT FOR THE FOREGOING WARRANTIES, THE PRODUCTS ARE SOLD AS-IS AND WITHOUT ANY OTHER WARRANTY OF ANY NATURE WHATSOEVER. MES HAS NOT MADE AND DOES NOT MAKE ANY OTHER REPRESENTATION, WARRANTY, GUARANTY, OR COVENANT, EXPRESS OR IMPLIED, WITH RESPECT TO THE DESIGN, CONDITION, DURABILITY, SUITABILITY, FITNESS FOR USE, FITNESS FOR A PARTICULAR PURPOSE, OR MERCHANTABILITY OF THE SQA IN ANY RESPECT. UNDER NO CIRCUMSTANCES AND IN NO EVENT, WHETHER AS A RESULT OF BREACH OF CONTRACT OR WARRANTY, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHERWISE, INCLUDING BUT NOT LIMITED TO INACCURATE RESULTS OR OPERATOR ERROR, SHALL MES BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES. IN NO EVENT SHALL MES'S LIABILITY WITH RESPECT TO THE PRODUCT EXCEED THE PURCHASE PRICE FOR SUCH PRODUCT.

**Extended service contracts are available for purchase.  
Please contact the dealer or supplier for information.**

Serial Number: _____	Date Purchased: _____
Dealer: _____	Dealer Phone #: _____
Purchaser: _____	Purchaser Phone #: _____

## Appendix 14- Regulatory Information

### **European Authorized Representative:**

Arazy group GMBH.

The Squalre 12, Am Flughafen, 60549 Frankfurt am Main, Germany

Email: [germany@arazygroup.com](mailto:germany@arazygroup.com) Tel: +49 69959325090

### **Australian Sponsor:**

Acrapack Pty Ltd, Anne Jones

7/ 84 Poinciana Avenue, Tewantin QLD Australia 4565

Email: [anne@acrapack.onmicrosoft.com](mailto:anne@acrapack.onmicrosoft.com)

### **Japanese MAH:**

Jaffco LTD, Hirofumi Morita

Email: [hiro0205@xd5.so-net.ne.jp](mailto:hiro0205@xd5.so-net.ne.jp)

17-15 Komazawa 1-chome Setagaya-ku

Tokyo 1540012

JAPAN

### **Manufacturer:**

Medical Electronic Systems, Ltd. 20 Alon Hatavor St., Zone 6, P.O.

Box 3017, Caesarea Ind. Park 3088900, Israel

Catalog # 5139