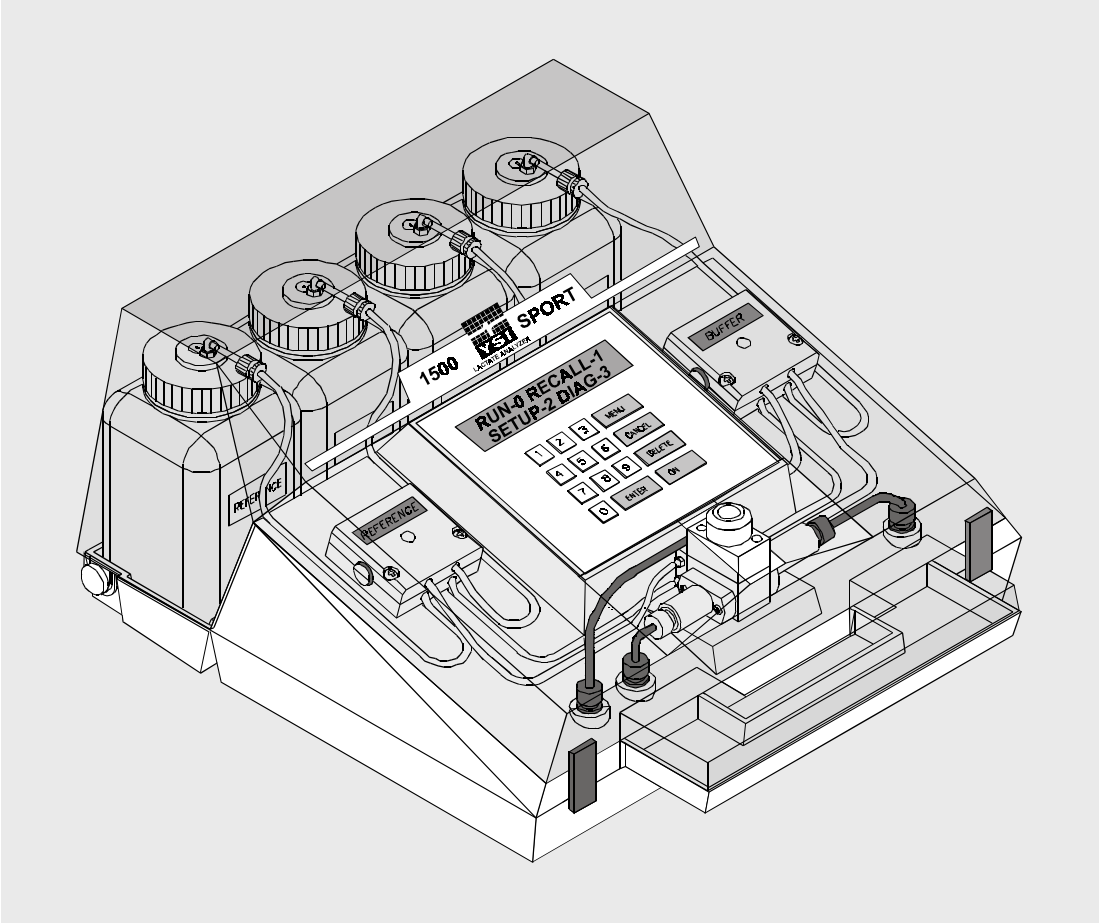
YSI Life Sciences



User's Manual
YSI 1500 Sport
L-Lactate Analyzer

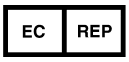
Data for Life.®

www.YSI.com

Table of Contents

1. Safety

1.1 Explanation of Symbols

	WARNING	Warning indicates that misuse of the instrument could result in death or serious injury to a person.
	CAUTION	Caution, consult accompanying documents. Caution indicates that misuse of the instrument could result in mild or serious injury to a person and/or damage to equipment.
		Biological Risks
		Manufacturer
		Authorized Representative in the European Union
		In Vitro Diagnostic Medical Device
	2747	Catalog number
	03A6549	Lot number
	YEAR-MO	Date of manufacture
	YEAR-MO	Use by Date
		Temperature Limitation

2. Introduction

The YSI 1500 SPORT is a portable, battery powered blood lactate analyzer intended for professional use in sports medicine applications. The SPORT is not intended for home use. It is designed to provide quick measurement of lactate in whole blood or plasma. Samples are injected with either a YSI 1501 blunt needle syringepet or a YSI 1502 capillary tube holder/injector. The SPORT automatically senses either of these injection devices, and from that point it completes the sample analysis, displaying the result and readying itself for any subsequent samples. Each sample is stored in memory, identified by date and time, and also by athlete/sample ID number, if desired. You can recall and display up to 150 sample values or you can transmit all of the stored data to a personal computer via the RS232 communication port. An optional battery-powered printer is also available to make hard copy records of the results.

2.1 Features

- Size: 13.4(W) x 14.8(L) x 7.0(H) inches, 10 lb.

  33.0 x 27.9 x 17.8 cm, 4.53 kg.
- Water resistant (splash-proof).
- Rechargeable 12 VDC battery w/AC adapter. Minimum of 8 hours of use between charges. See Appendix F–Temperature Effect on Operation.
- Microprocessor control.
- Alpha-numeric liquid crystal display, 16 character by 2 line with adjustable contrast.
- Menu-driven interface.
- Automatic recognition of each sample injection.
- Automatic calibration.
- Athlete/sample ID# entry.
- Sample result recall (up to 150 stored in memory).
- Complete diagnostic software.
- Temperature compensation over a limited range.
- Printer option (infrared data link).
- RS-232 capability to log data to a computer.

2.2 Specifications

Sample size: 25 microliters

Sample Medium: Whole Blood; Plasma

Sampling Speed: Manual Mode: 60 seconds
Auto Mode: 96 seconds

Detection range: 0 to 30 mmol/L (0 to 270 mg/dL)

Resolution: 0.01 mmol/L (0.2 mg/dL)

Calibration point: 5 mmol/L (45 mg/dL)

Typical performance: See Appendix A for typical performance data for whole blood and plasma.

Operating Temperature Range: 5 to 45°C, 10 to 90% RH, non condensing

Storage Temperature Range: 0 to 60°C, 10 to 90% RH, non condensing

Rechargeable at 95 to 130 VAC with the 115 volt charger, or at 190 to 240 VAC with the 230 volt charger; 47 to 63 Hz.

Battery Charger Output: 13.8 VDC @ 300 milliamps

3. Instrument Setup

We urge you to read through the entire Operations Manual before starting to use the SPORT. Though the SPORT was designed for ease of operation, prompting you through each operational step, it is still helpful to know as much as possible about the instrument in order to get the most out of it.

3.1 Unpacking

Remove the instrument from its shipping container. Be careful not to discard any parts or supplies. Check off all items on the packing list and inspect all assemblies and components for damage. If any parts are damaged or missing, contact YSI Customer Service or your Dealer Representative immediately.

Do not discard the shipping container.

If servicing is required, the instrument must be returned to the YSI Repair Center. Field service is not available on this instrument. We strongly recommend that you use the original shipping container for this purpose as it was designed to protect the instrument during transport.

Reagents and injection devices for the SPORT analyzer are not packaged in the same carton as the instrument. Reagents come in a starter kit (YSI 1504); and injection devices (YSI 1501 or 1502) must be ordered separately.

⚠ WARNING: Always make sure the SPORT power is turned off prior to connecting the battery charger. Failure to do this could result in stored data corruption if the battery has been discharged to a very low level.

3.2 Component Identification

This section names the principal parts and describes their use. Figure 3.1 and Figure 3.2 identify each part.

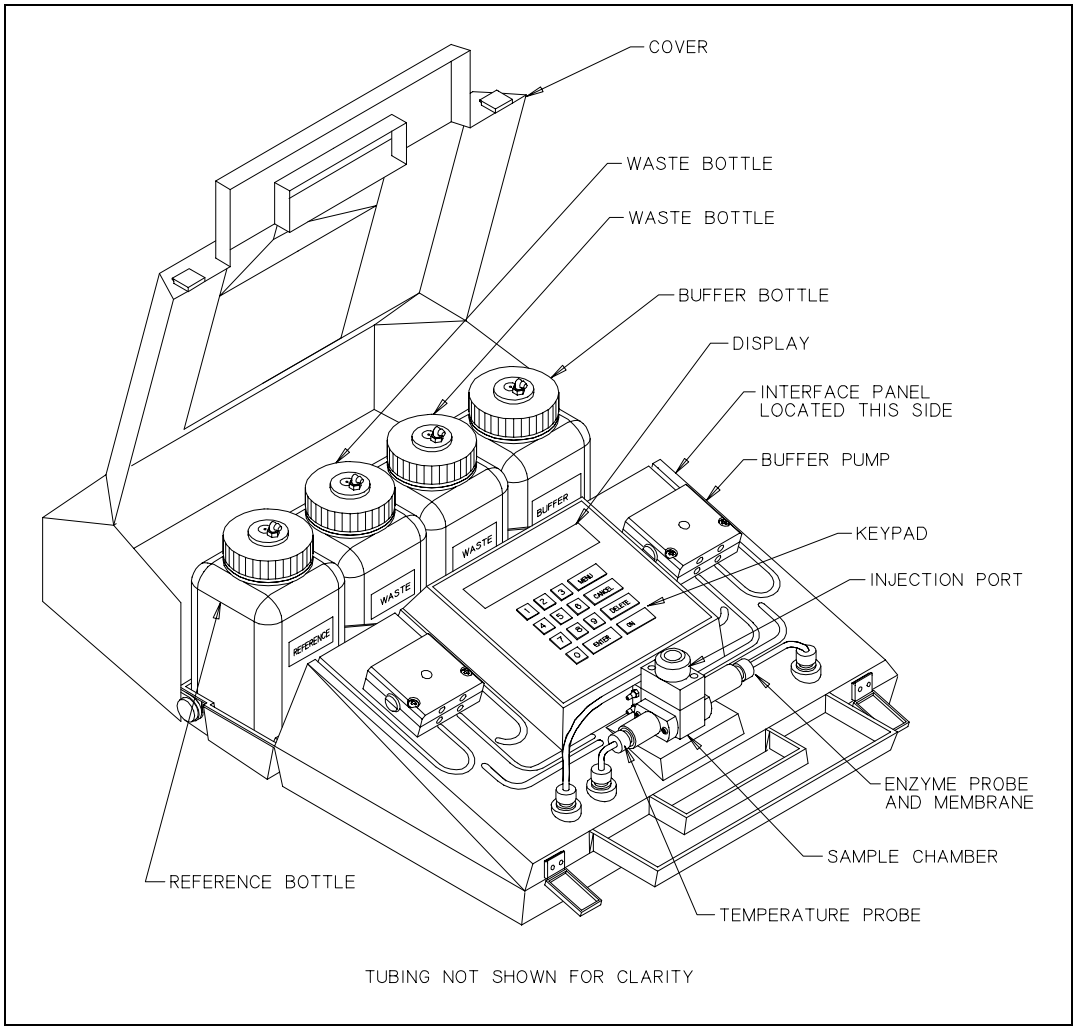


Figure 3.1 SPORT

The **Buffer, Reference** and **Waste Bottles** in the rear of the instrument are used to hold the solutions needed for sample analysis.

The **Buffer Pump** is a two-channel peristaltic pump driven by a gearmotor. One channel, (the lower body), draws buffer from the Buffer Bottle and pumps it through the Sample Chamber. The second channel, (the upper body), draws fluid from the waste chamber and pumps it into the Waste Bottle.

The **Reference Pump** is identical in operation to the Buffer Pump. It is used to pump the reference solution.

The **Sample Chamber** is made of clear acrylic plastic. White and black probe holders are attached to the sides. The enzyme probe is in the white holder. The membrane is mounted on an O-ring that serves as a fluid seal between the chamber and the probe. The temperature probe is in the black holder. A small black O-ring on the tip of the temperature probe serves as a fluid seal.

The **Injection Port** is on the top of the Sample Chamber. Inside the port is a sensor that detects the insertion of a YSI injection device. A removable cap is threaded into the top of the Injection Port. This cap must be removed and replaced with the supplied threaded plug before moving or storing the instrument.

The **Keypad** is a 15 key membrane switch with numeric keys from 0 to 9, and 5 function keys, ENTER, MENU, CANCEL, DELETE, and ON.

The **Display** is a 2 line by 16 character liquid crystal display.

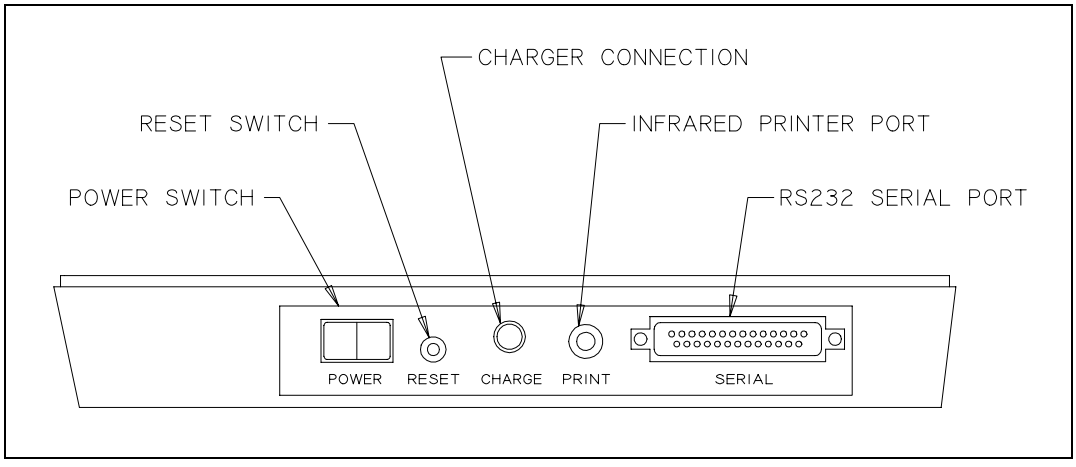


Figure 3.2 SPORT Interface Panel

The following switches and connectors are located in a recessed area on the side of the instrument.

The **Reset Switch** is used for a hard reset of the operating system.

The **Remote Communication Port** is a 25 pin RS232C serial port. It is used to interface with personal computers.

The **Power Switch** is a rocker switch that allows you to control power to the instrument.

The **Infrared Printer Port** is used to transmit data to the optional battery powered printer.

The **Power Receptacle** is a DC power inlet. The battery charger supplied with the SPORT is connected here to recharge the instrument battery.

IMPORTANT: Probe polarization will be disrupted when power is turned off. Time for restabilization will be needed when power is restored.

3.3 Reagent Preparation

If you are going to use only the manual mode of operation, the only solution you will need to prepare is the Buffer solution as the Reference solution is only used as part of the Automatic mode.

You can prepare the reagent solutions for the SPORT yourself. These reagents, along with a mixing bottle and a graduated syringe (3cc), are provided in the YSI Model 1504 Starter Kit which must be ordered separately. Please note that the reagents in the starter kit may also be ordered separately.

IMPORTANT: The mixing bottle and Syringe must be cleaned every week. See Section 8.2 Preventative Maintenance.

If your sample measuring protocol requires the total lysis of blood cells, or if you are going to preserve the samples in YSI 2372 Preservative Tubes for later analysis, you must refer to Appendix D Sample Preservation, for further information before proceeding.

Automatic Mode

Buffer Solution

Fill the 500mL mixing bottle with reagent water. Reagent water must be very pure. Use high quality deionized or distilled water. Add one package of YSI 2357 Buffer Concentrate and stir, waiting long enough to be certain that the buffer chemicals have completely dissolved.

Pour buffer solution into the instrument Buffer Bottle. Put the cap back on the Buffer bottle and place it back into the instrument.

Reference Solution

Prepare 500 mL of Buffer solution, pour it into the Reference Bottle and add to it 4.5 cc of YSI 1530 30 mmol/L Calibration Standard. This should be measured out with the graduated syringe supplied in the 1504 Starter Kit. Replace the bottle lid and shake the bottle for 15 seconds to insure complete mixing. **It is important for reliable results that the reference solution is completely mixed.**

Rinse the mixing bottle with deionized or distilled water.

IMPORTANT: Screw the bottle lids on tightly before putting them back into the instrument. If you don't, fluid may leak out when you pick up the SPORT by its handle.

Manual Mode

Buffer Solution

Fill the 500mL mixing bottle with reagent water. Reagent water must be very pure. Use high quality deionized or distilled water. Add one package of YSI 2357 Buffer Concentrate and stir, waiting long enough to be certain that the buffer chemicals have completely dissolved.

Pour the buffer solution into the instrument Buffer Bottle. The remaining fluid may be saved inside the mixing bottle until it is needed later.

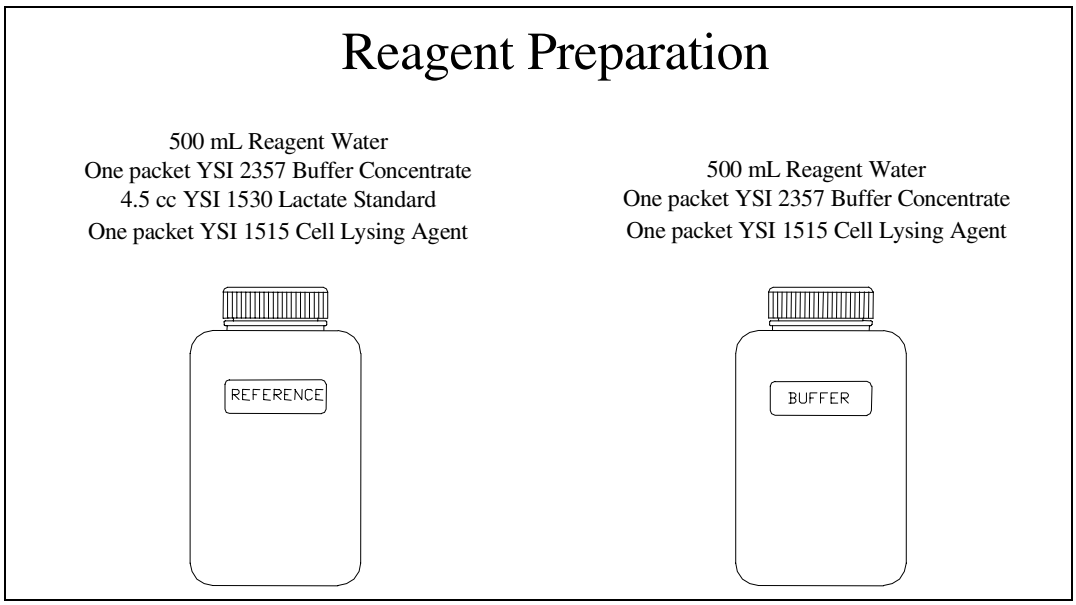


Figure 3.3 Reagent Preparation

3.4 Membrane Installation

The starter kit contains a pack of four YSI 2329 lactate membranes.

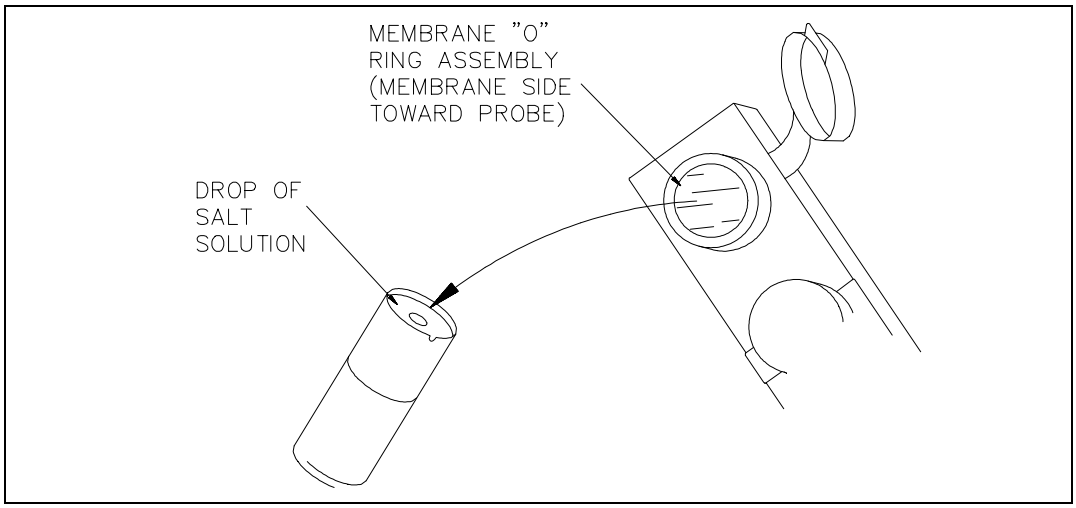


Figure 3.4 Enzyme Membrane Installation

To install a membrane, first unscrew the probe retainer and pull out the probe. Remove the membrane assembly that's on it. You can use a toothpick or pointed tool to unseat the old membrane. Be careful not to scratch the probe face. Open one compartment of the plastic membrane pack and rinse the membrane inside with a few drops of salt solution (YSI 2392 is provided in the 1504 starter kit). Place one drop of salt solution on the probe face. Then, using the plastic membrane pack as an applicator, press the O-ring membrane assembly gently onto the probe face (Figure 3.4). Be sure the membrane is seated on the probe face. The top of the O-ring will be flush with the shoulder. Wipe excess salt solution from the probe body, then return the probe to the sample chamber. Finger tighten the probe retainer so that the O-ring makes the necessary seal. Return the membrane holder to the foil pouch and refrigerate it. Note the expiration date on the membrane package. We recommend that you keep a logbook in which the dates and lot numbers of reagents are recorded, along with data from daily operational checks and other relevant information.

3.5 Power

If the SPORT is being powered up for the first time or it has been unused for some period of time, the first thing you should do is connect the battery charger.

⚠ CAUTION: Make sure the SPORT power is turned off before plugging in the battery charger.

In normal use, you can leave the power on as long as you like provided the battery charger is connected. Leaving the charger connected and the power on will prevent the battery from discharging and requiring charging prior to the next usage. If the SPORT is stored with the power on and the charger disconnected, the battery will discharge to a level requiring a recharge within 3 days.

YSI recommends that the SPORT be used with the battery charger whenever AC power is available.

IMPORTANT: Probe polarization will be disrupted when power is turned off. Time for restabilization will be needed when power is restored.

Either of the following displays confirm correct power-up:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

```
CONNECT CHARGER
PRESS ON
```

If the display prompts you to connect the charger, you may do so at this time without turning off the power switch. The software will prohibit running until the battery has been sufficiently recharged. Refer to Section 9 Troubleshooting for more information.

If neither of these displays become active, press the Reset pushbutton located on the side of the unit. If the SPORT fails to respond, turn off all power and call YSI Technical Support.

3.6 System Setup

You use menus to set up the SPORT system. Once set up, the system parameters are maintained in memory until they are changed purposely.

IMPORTANT: The SPORT allows you to go through each menu step by step by selecting options on the display. Each menu has a number of options, and each option is identified by a number. Pressing the number that corresponds to the desired option moves the display cursor to that option. However, the selection will not be made until you press ENTER. Whenever a new menu is displayed, the cursor defaults to the option identified by the digit 0. Refer to Figure 3.5 for the keypad layout and cursor location.

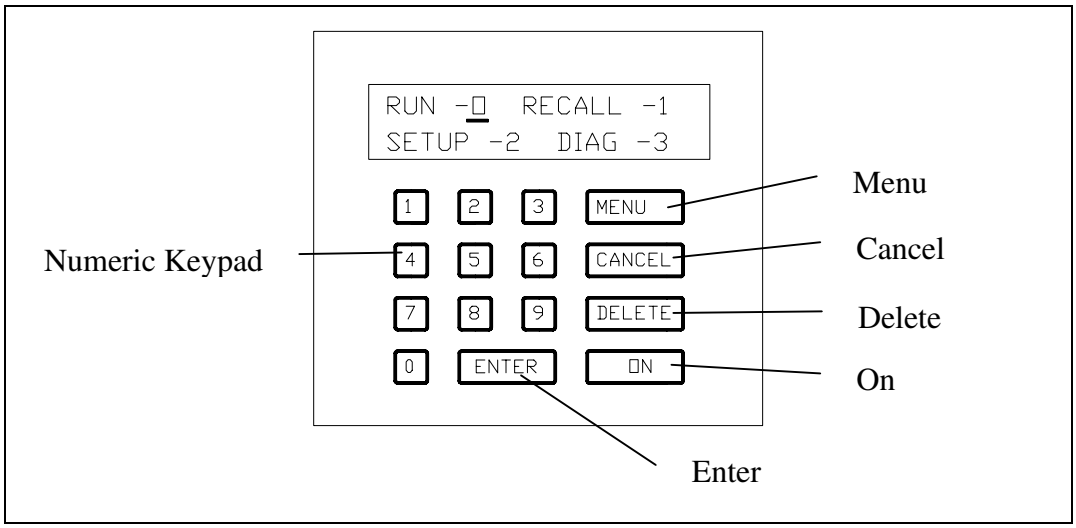


Figure 3.5 SPORT Keypad

How the five function keys and the numeric keypad are used:

- **ON**- ON is used as a user acknowledgement of a low battery condition.
- **ENTER** - ENTER commits the data you've keyed in with the numeric keypad. It does this from any menu at any level.
- **MENU** - Each time you press MENU, you back up one level to the previous menu.
- **CANCEL**- CANCEL stops the current operation, starts a wash cycle and brings up the Main menu.
- **DELETE** - DELETE is active only when the display is showing recalled sample values. It is used to delete the value showing at the moment.
- **NUMERIC KEYPAD** - The keys numbered from 0 to 9 allow you to enter time, date, ID numbers, menu selections and other data.

The following sections in this chapter show you how to set up the instrument. The correct display for each step is shown. If the display does not respond as shown, press **MENU** and try again. Instructions are given starting each time from the Main menu. As you become more familiar with the menu structure this will not be necessary.

Date

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Setup by pressing **2**, then **ENTER**.

```
DATE-0 TIME-1
RS232-2 MORE-3
```

Select Date setup by pressing **ENTER**.

```
DATE MM/DD/YY
XX/XX/XX DAY
```

The first and second digits you press define the desired month; 01 is January and 12 is December. The third and fourth digits you press define the date; you can enter any pair of digits from 01 to 31. The fifth and sixth digits define the last two digits of the desired year. When you see the date you want on the screen, press **ENTER**.

Example: January 15, 2003 is entered as **01 15 03 ENTER**

```
DATE MM/DD/YY
01/15/03 WED
```

If you have entered an impossible date, January 99, 2003 for example, the display will read:

```
DATE? PRESS ENTER
01/99/03
```

Press **ENTER** to get back to the previous menu for another attempt to set the date.

If the date you have entered is acceptable, press **MENU** until you return to the Main menu.

Time

The SPORT incorporates a 24 hour clock.

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Setup by pressing **2**, then **ENTER**.

```
DATE-0 TIME-1
RS232-2 MORE-3
```

Select Time by pressing **1**, then **ENTER**.

```
TIME HH:MM:SS
XX:XX:XX
```

The first and second digits that you press define the desired hour; 06 is 6 am and 18 is 6 pm. The third and fourth digits you press define the minute; you can use anything between 00 and 59. The fifth and sixth digits define the seconds. If the time you see on the display is what you want, press **ENTER**.

Example: Nine thirty in the morning would be entered as **09 30 00 ENTER**

```
TIME HH:MM:SS
09:30:00
```

If you have entered an impossible time, 99:00:00 for example, the display will read...

```
TIME? PRESS ENTER
99:00:00
```

Press **ENTER** to return to the previous menu for another attempt to enter the time.

If the time of day you have entered is accepted, press **MENU** until you return to the Main menu.

RS232 Communication

It is possible to send all of the stored sample data to a personal computer, but in order to do so a communication software package is required to be installed in the PC. Once the communication package is installed in the PC, it is simply a matter of making sure the settings of the PC and the SPORT are the same. The SPORT is flexible and allows many choices.

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Setup by pressing **2**, then **ENTER**.

```
DATE-0 TIME-1
RS232-2 MORE-3
```

Select RS232 by pressing **2**, then **ENTER**.

```
DATA-0 BAUD-1
STOP-2 PARITY-3
```

Select bit data by pressing **ENTER**.

```
7 BIT-0
8 BIT-1
```

Select the desired setting by number, then **ENTER**. The display will return to the previous menu.

```
DATA-0 BAUD-1
STOP-2 PARITY-3
```

Select baud rate by pressing **1**, then **ENTER**.

```
300 BAUD-0
1200 BAUD-1
```

Select the desired setting by number, then **ENTER**. The display will return to the previous menu.

```
DATA-0 BAUD-1
STOP-2 PARITY-3
```

Select stop bits by pressing **2**, then **ENTER**.

```
STOP BITS
1 -0 2-1
```

Select the desired setting by number, then **ENTER**. The display will return to the previous menu.

```
DATA-0 BAUD-1
STOP-2 PARITY-3
```

Select parity by pressing **3**, then **ENTER**.

```
NONE-0 EVEN-1
ODD-2 HI-3 LO-4
```

Select the desired setting by number, then **ENTER**. The display will return to the previous menu.

Setting the LCD Contrast

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Setup by pressing **2**, then **ENTER**.

```
DATE-0 TIME-1
RS232-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
LCD-0 RADIX-1
STIR-2 MORE-3
```

Select LCD by pressing **ENTER**.

```
LCD      DARKER-0
         LIGHTER-1
```

The contrast can be adjusted up and down by pressing the appropriate number

and then the **ENTER** key. The adjustment will increment with each pressing of the **ENTER** key.

Press **MENU** until the Main menu reappears.

Displaying Numerical Values in RADIX

The default setting shows a period separating the integer part of the number from the decimal fraction. If you turn on the RADIX mode, a comma will appear instead of a period.

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Setup by pressing **2**, then **ENTER**.

```
DATE-0 TIME-1
RS232-2 MORE-3
```

Select MORE by pressing **3**, then **ENTER**.

```
LCD-0 RADIX-1
STIR-2 MORE-3
```

Select the RADIX mode by pressing **1**, then **ENTER**.

```
RADIX
PERIOD-0 COMMA-1
```

Turn the RADIX mode on by pressing **1**, then **ENTER**.

Press **MENU** until the Main menu reappears.

Setting the Stirring Speed

The stirring speed can be adjusted to assure consistent stirring. When making this adjustment, speed up the stirring until the stir bar tumbles inside the sample chamber. Once you have done this slowly reduce the stirring speed until the stir bar settles into a uniform spinning motion.

Go to Main menu by pressing **MENU** until you see:

RUN-0 RECALL-1
SETUP-2 DIAG-3

Select Setup by pressing **2**, then **ENTER**.

DATE-0 TIME-1
RS232-2 MORE-3

Select More by pressing **3**, then **ENTER**.

LCD-0 RADIX-1
STIR-2 MORE-3

Select Stir by pressing **2**, then **ENTER**.

STIR SPEED
UP-0 DN-1

Pressing the **ENTER** key will speed up the stirring by a preset increment.
Pressing **1**, then **ENTER** will slow down the stirring by a preset increment.

Press **MENU** until the Main menu reappears.

Selecting the Displayed Units

Go to Main menu by pressing **MENU** until you see:

RUN-0 RECALL-1
SETUP-2 DIAG-3

Select Setup by pressing **2**, then **ENTER**.

DATE-0 TIME-1
RS232-2 MORE-3

Select More by pressing **3**, then **ENTER**.

LCD-0 RADIX-1
STIR-2 MORE-3

Select More by pressing **3**, then **ENTER**.

```
UNITS-0 MODE-1
SET DEFAULT-2
```

Select Units by pressing **ENTER**.

```
UNITS: mg/dL-0
       mmol/L-1
```

Select mg/dL by pressing **ENTER**, or select mmol/L by pressing **1**, then **ENTER**.

Press **MENU** until the Main menu appears.

Selecting the Operational Mode

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Setup by pressing **2**, then **ENTER**.

```
DATE-0 TIME-1
RS232-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
LCD-0 RADIX-1
STIR-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
UNITS-0 MODE-1
SET DEFAULT-2
```

Select Mode by pressing **1**, then **ENTER**.

SET CAL MODE AUTO-0 MANUAL-1

Select Auto mode by pressing **ENTER**, or select Manual mode by pressing **1**, then **ENTER**.

IMPORTANT: After pressing **1** then **ENTER** to select Manual mode, the cursor returns to its default location (under the 0), however, the instrument is now in Manual mode.

Press **MENU** until the Main menu appears.

Resetting System Default Parameters

If the system is reset, all stored results will be erased; time, date and stir speed will have to be manually reset to correct settings; and the analyzer will require recalibration.

The system will be reset to a series of default settings which are listed below.

RS232 Communications:

Baud rate:	1200
Data:	8 bits
Stop bits:	1
Parity:	None

Mode: Automatic Calibration

Stir speed: Maximum

Memory: Cleared: All stored results deleted

Radix: Period

Units: mg/dL

Go to Main menu by pressing **MENU** until you see:

RUN-0 RECALL-1 SETUP-2 DIAG-3

Select Setup by pressing **2**, then **ENTER**.

```
DATE-0 TIME-1
RS232-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
LCD-0 RADIX-1
STIR-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
UNITS-0 MODE-1
SET DEFAULT-2
```

Select Default by pressing **2**, then **ENTER**.

```
ARE YOU SURE?
NO -0 YES -1
```

To set all system parameters to the default settings press **1**, then **ENTER**. The display will read

```
A FEW SECONDS
DELAY...
```

```
UNITS-0 MODE-1
SET DEFAULT-2
```

Press **MENU** to return to the Main menu.

3.7 Preparing the Fluid System

Once you have setup the electronics of the instrument, filled both supply bottles, and emptied the waste bottle, you are ready to prime the fluid system. You must return to the Main menu.

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Press **ENTER** to get to the Run mode. You will see this display:

```
SAMPLE-0
CAL-1 PRIME-2
```

Select PRIME by pressing **2**, then **ENTER**. You will see this display:

```
PRIMING...
REF ON STIR ON
```

The instrument will run the reference fluid pump for approximately 30 seconds in order to fill the tubing lines. Once the cycle has ended you will see this display:

NOTE: The reference pump will only cycle if the selected mode is Automatic, if Manual has been selected only the wash cycle will be called.

```
WASHING...
```

The instrument will run the buffer fluid pump for approximately 30 seconds in order to fill the tubing lines. Once the cycle has ended you will see:

```
PRESS MENU
```

Press **MENU** to return to the previous display, you are now ready to calibrate and run samples on your instrument.

3.8 Printer Option

While there is not a printer built into the instrument, there is a optional printer available either through YSI (Model 1506), or your local Hewlett Packard dealer. This printer, HP Model 82240, is a battery-powered unit controlled by an infrared signal that is generated from the SPORT. The signal originates from the recessed interface panel located on the right hand side of the instrument. It is important that the printer be positioned in such a way as to not interrupt this signal. This is important because the SPORT sends data only and does not have the ability to acknowledge the reception of the data. Please refer to Figure 3.6 Printer Placement for positioning details.

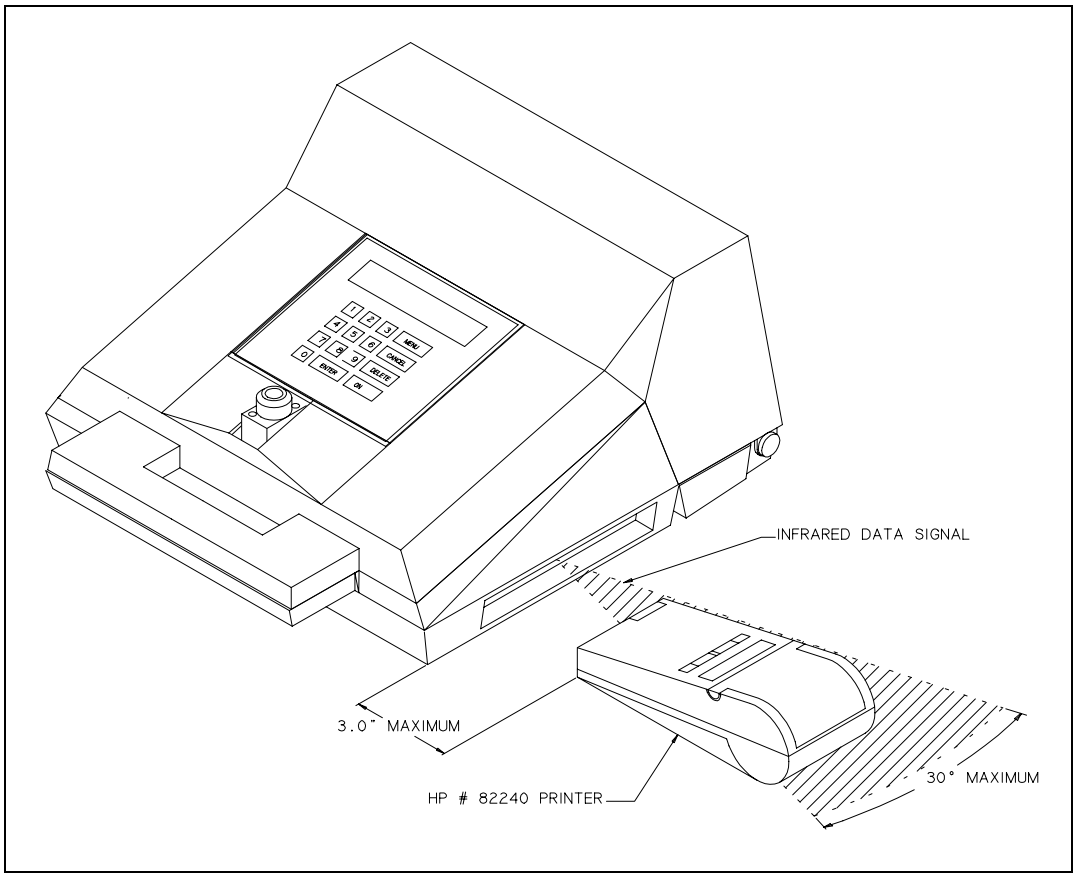


Figure 3.6 Printer Placement

The instrument has the capability to print the data while running the samples or you may print the results later, selectively by date or sample identification number. Refer to Section 6.3 Recalling Stored Results.

Printing the results as you run samples also allows you access to information that is only available during this cycle. Along with the actual result you will also have a record of the temperature, initial baseline current, sample current, and reference current. The exact sample format is shown in Figure 3.7 Print Format.

A similar printout is generated when calibrating and checking linearity. We recommend that the printer be used in this manner whenever possible for two reasons. One, if there were a complete electrical failure or accidental re-formatting of the memory, it could be possible that the sample results in memory may be lost or irretrievable. Two, the additional information on the printout is extremely helpful in detecting performance trends should the need arise for troubleshooting.

```
SAMPLE
---------------------------------
TEMP        22.44 C
BASCUR      1.28 nA
SAMCUR      21.73 nA
REFCUR1     11.12 nA
---------------------------------
04/08/98    09:08
# 001       10.07 mmol/L
++++++++++++++++++++++
```

Figure 3.7 Print Format

The exact format for a calibration or linearity printout provides the same relevant information but appears slightly different.

4. Sample Collection, Preparation and Measurement

The SPORT is a versatile instrument that allows you to manipulate the sample in a number of different ways.

- You can collect the blood sample using a lancette and capillary tube, or by venapuncture into a tube or other collection device, such as a vacutainer.

- The SPORT can be used with 2 injection devices. The YSI 1501 25 microliter syringepet, ideal for drawing samples from a blood collection tube, and the YSI 1502 25 microliter capillary tube injector, designed for injection directly from a YSI capillary tube.

- The sample can be prepared for immediate assay, or for later analysis. If you are going to preserve your sample for later analysis, there are specific instructions that must be followed in order to insure the most accurate results. Please refer to Appendix D Sample Preservation.

For more information on obtaining blood samples, we refer you to two publications:

Approved Standard Procedures for the Collection of Diagnostic Blood Specimens by Skin Puncture, edited by Jean M. Slockbower. National Committee for Clinical Laboratory Standards, Volume 2 Number 5, pages 132-149, 1982.

Collection and Handling of Laboratory Specimens. A Practical Guide, edited by Jean Slockbower and Thomas A. Blumenfield. J. B. Lippincott Company, Philadelphia, 1983. ISBN 0-397-50520-5.

4.1 Sample Preparation

The blood from a finger or earlobe prick should be collected in a capillary tube. If you use one of the YSI tubes, which are preset to 25 microliters, you must inject it with the capillary tube injector. You can also draw venapuncture blood from a vial, vacutainer, or YSI Preservative Tube with the preset tube.

If the capillary tube has a capacity greater than 25 microliters, the blood sample must be transferred to the YSI 1501 Syringepet for injection. You can also use the Syringepet to sample and inject blood from a venapuncture vial or vacutainer.

The following sections instruct you in the use of both injection devices.

YSI Model 1501, 25 microliter Syringepet

The Syringepet can be used to extract a 25 microliter sample from either a vacutainer or a capillary tube of greater volume than 25 microliters, see Figure 4.1.

Begin with a sample volume greater than 75 microliters. To remove any contaminants from the Syringepet, you should rinse it three times with buffer or reagent-quality water. For maximum accuracy you should rinse it with buffer or reagent water at least twice, and then with the sample twice, before loading it for injection.

⚠ **WARNING:** Precision and accuracy are dependent on sample loading technique. Any air in the sample column will cause incorrect results.

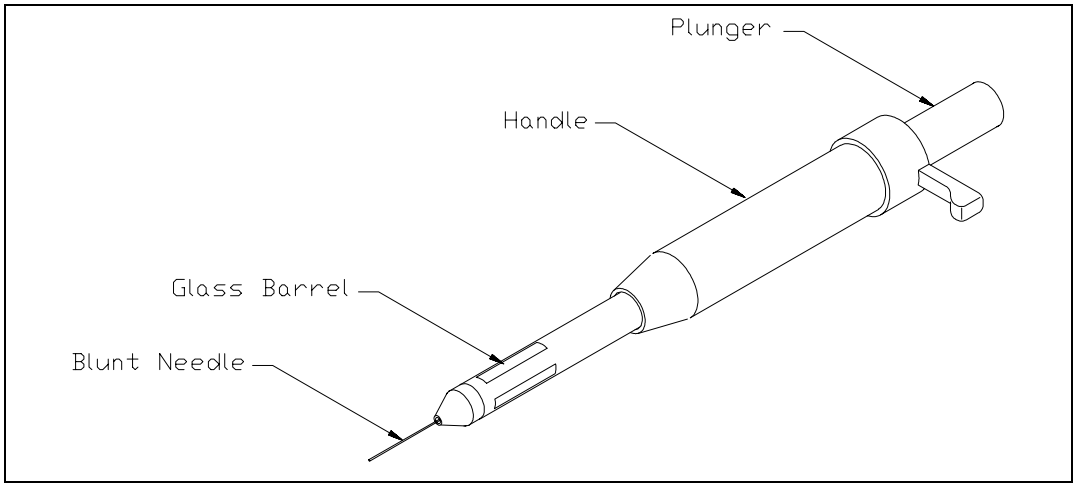


Figure 4.1 1501 Syringepet

Using the Syringepet may feel awkward at first, but you must master the technique to get accurate results. Practice injecting Calibration standards into the instrument. This will allow you to develop the necessary technique while also letting you visually assess how well you are doing by checking the result on the display.

Depress the plunger all the way with your thumb. Lower the Syringepet needle into the sample, then **slowly**, using light thumb pressure, let the plunger come all the way back.

Examine the glass barrel to see if there are any air bubbles in the sample. If there are any, dispense the sample back into the container you drew it from and try again. If there are no air bubbles present you are ready to inject the sample into the instrument.

Once you are sure the sample is ready for injection, hold the Syringepet directly above the injection port and slide the needle in until you feel it stop. Press in the plunger all the way with your thumb. Keeping thumb pressure on the plunger, remove the Syringepet from the port.

WARNING: Any sample carryover on the outside of the needle could affect the measurement. You should wipe off the tube or Syringe pet needle with a sterile wipe, like a Kimwipe, prior to each sample injection.

YSI Model 1502 Capillary Tube Injector

YSI 1505 capillary tubes are provided in the Starter Kit. These tubes, which can be ordered separately, are preset to a volume of 25 microliters. There is a double white band on the tube opposite the end that you put into the sample.

You may load the capillary tube into the injector before collecting the sample or you may collect the sample first, then load the tube.

WARNING: Precision and accuracy depend on sample loading technique. Any air in the sample column will cause incorrect results.

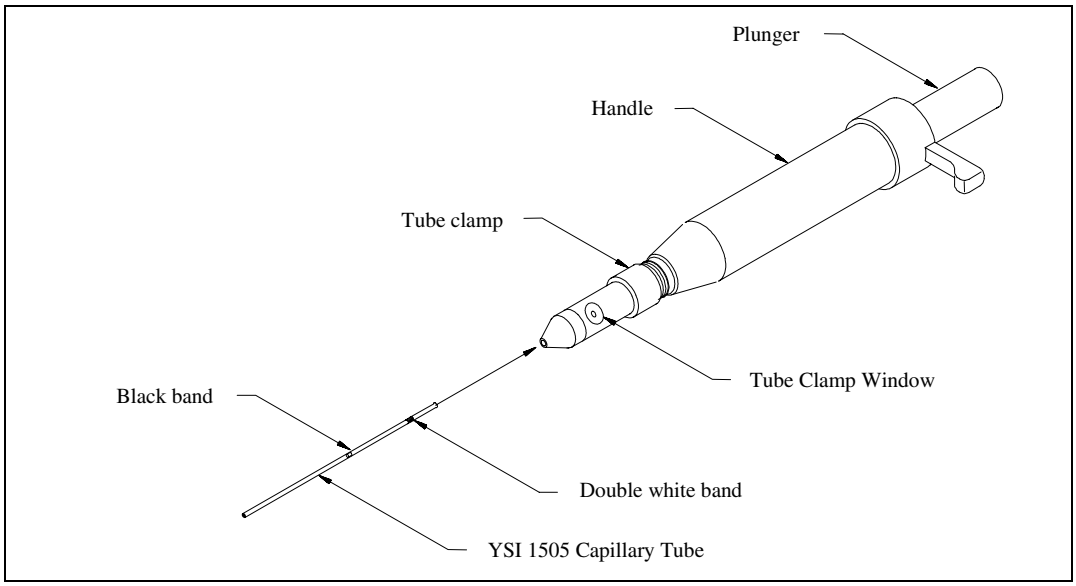


Figure 4.2 1502 Capillary Tube Injector

The end of the tube with the double white band goes into the injector first. The collar around the front part of the injector barrel is the tube clamp. Each time you insert or withdraw a capillary tube, you loosen or tighten the tube clamp so that the capillary tube can be inserted or withdrawn easily without sticking. Just a small adjustment of the tube clamp one way or the other is necessary.

Slide the tube all the way in until it stops. The tube should be sticking out about 1/2 an inch (12 mm), sample will be visible in the section of the tube that is protruding, and the black band should be visible in the tube clamp window.

When you adjust the clamp, it is not necessary to unscrew it completely. Never should more than one full turn be necessary.

WARNING: Any sample carryover on the outside of the tube could affect the measurement. You should wipe off the tube or Syringepet needle with a sterile wipe, like a Kimwipe.

Hold the injector directly above the injection port, and slide it into the port until you feel it stop. In one motion, press the plunger all the way down with your thumb. Maintaining pressure on the plunger after it has bottomed out, remove the injector from the port.

Release the tube clamp and slide the used tube out of the injector.

WARNING: The used capillary tube is a biohazard and should be disposed of in a manner consistent with safety and the laws in your area.

5. Principles of Operation

5.1 Sensor Technology

The sensor technology of the YSI SPORT is based on the principles conceived by Dr. Leland Clark, formerly of Children's Hospital Foundation, Cincinnati, Ohio. The immobilized enzyme membrane was invented by YSI and is covered by U.S. Patent 4,073,713. This sensor technology has been used successfully since 1975 in the YSI 23A Blood Glucose Analyzer; then later in the YSI 27 Industrial Analyzer, the YSI 23L Blood Lactate Analyzer, the YSI 2300 STAT Glucose/L- Lactate Analyzer, and the YSI 2700 SELECT Chemistry Analyzer.

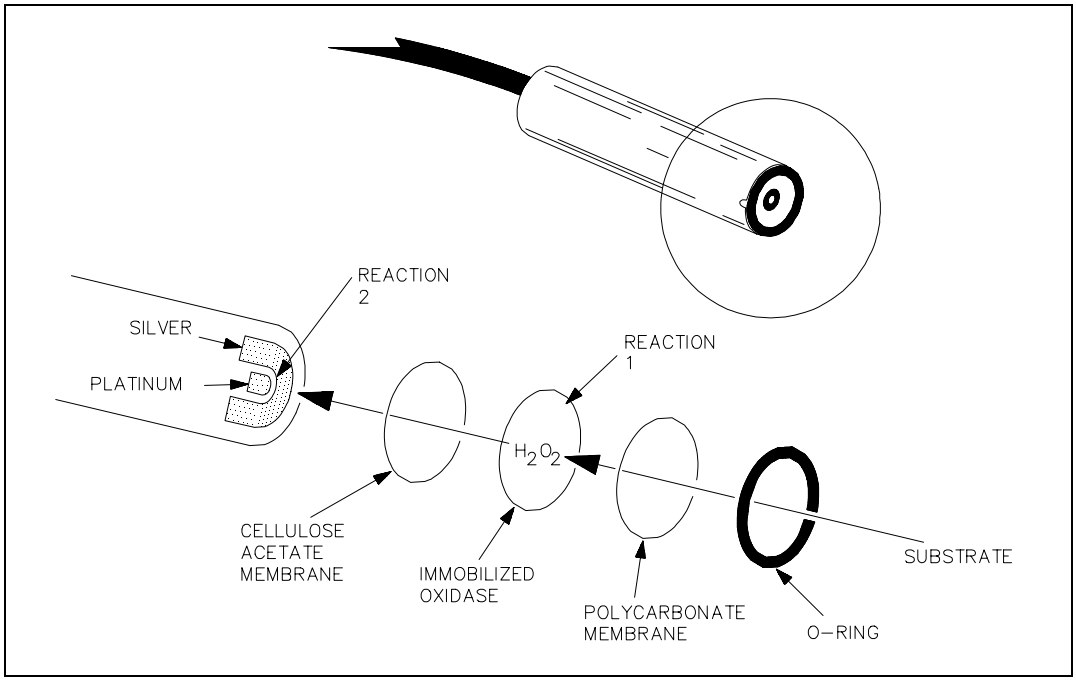


Figure 5.1 Sensor Probe and Enzyme Membrane

The probe is fitted with a three-layer membrane containing immobilized lactate oxidase in the middle layer. Figure 5.1 shows an exploded view of the membrane and its relationship to the face of the probe. The face of the probe, covered by the membrane, is situated in a buffer-filled sample chamber into which a sample is injected. Some of the substrate diffuses through the membrane. When it contacts the immobilized enzyme (lactate oxidase), it is rapidly oxidized, producing hydrogen peroxide (Reaction 1). The hydrogen peroxide (H_2O_2) is, in turn, oxidized at the platinum anode, producing electrons (Reaction 2). A dynamic equilibrium is achieved when the rate of H_2O_2 production and the rate at which H_2O_2 leaves the immobilized enzyme layer become constant. Equilibrium is indicated by a steady state response. The electron flow is linearly proportional to the steady state H_2O_2 concentration and, therefore, to the concentration of lactate.

Reaction 1 (lactate):

$$\text{Lactate} + O_2 \xrightarrow[\text{LOx}]{} \text{Pyruvate} + H_2O_2$$

Reaction 2: $H_2O_2 \xrightarrow[\text{Pt anode}]{} 2H^+ + O_2 + 2e^-$

The platinum electrode is held at an anodic potential and is capable of oxidizing many substances other than H_2O_2. To prevent these reducing agents from contributing to sensor current, the membrane contains an inner layer consisting of a very thin film of cellulose acetate. This film readily passes H_2O_2but excludes chemical compounds with molecular weights above approximately 200. The cellulose acetate film also protects the platinum surface from proteins, detergents and other substances that could foul it. However, the cellulose acetate film can be penetrated by such compounds as hydrogen sulfide, low molecular weight mercaptans, hydroxylamines, hydrazines, phenols and anilines.

Certain detergents, endogenous and exogenous substances, preservatives and reducing agents can interfere with the SPORT sensor system, resulting in erroneous readings. (See Appendix E–Effects Of Selected Substances).

5.2 Fluid System

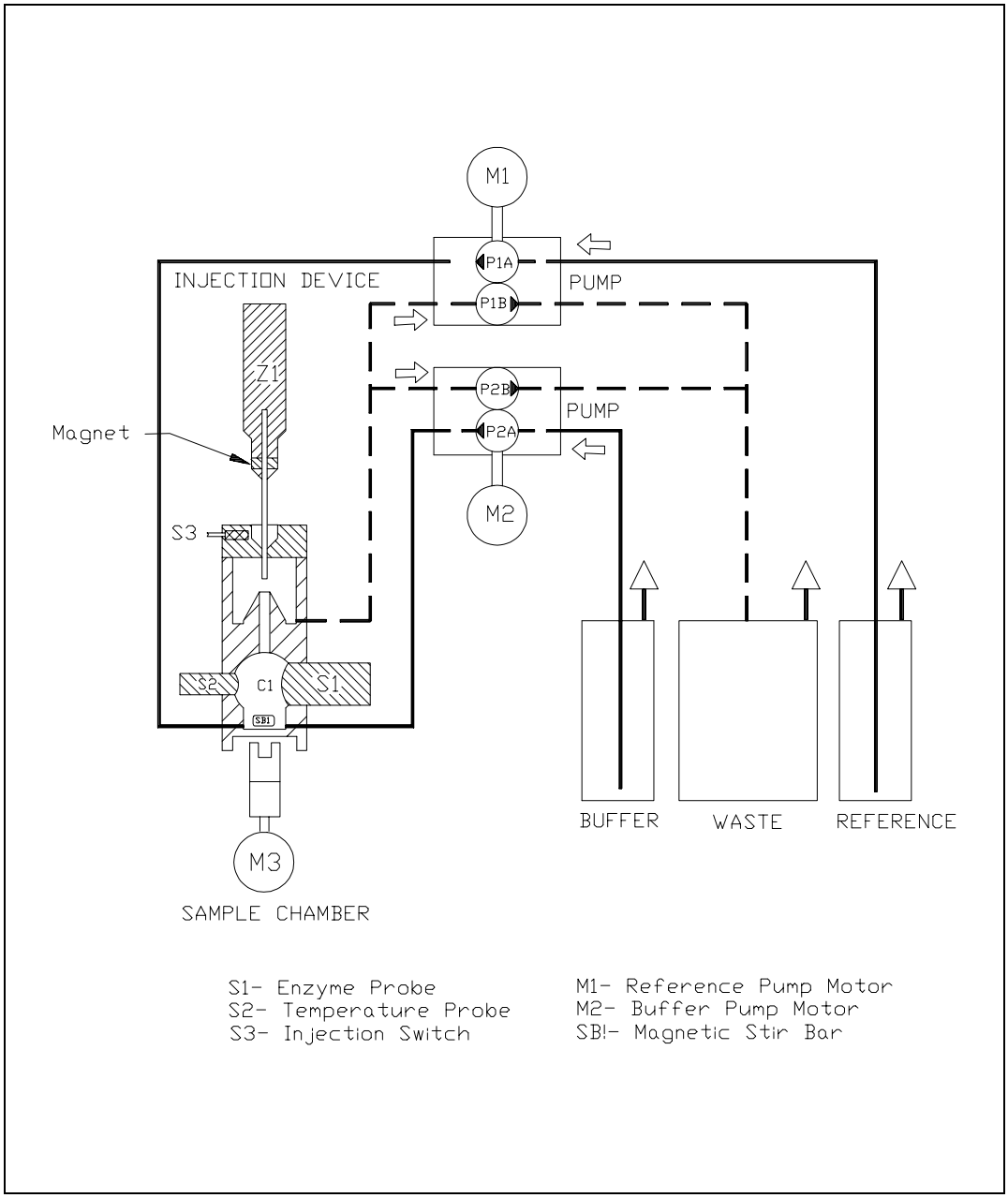


Figure 5.2 SPORT Fluid System

5.3 Measurement Methodology

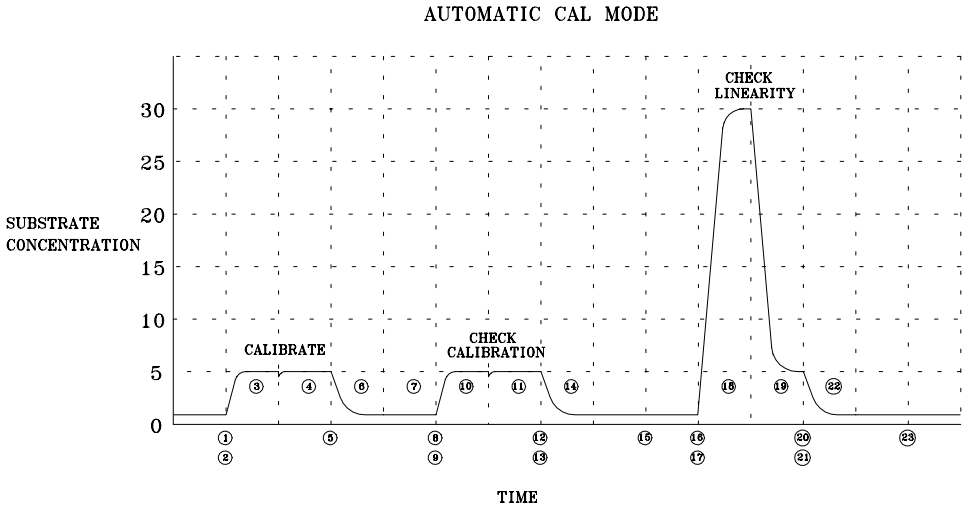
The algorithm used to calculate results allows the SPORT to process samples as quickly as possible while maintaining high accuracy and reliability. The result is calculated from a group of four readings, depending on the chosen operational mode:

- Initial baseline current
- Sample / Calibrator plateau current
- Reference plateau current (Auto mode only)
- Calibrator concentration value current

For initial calibration, 25 microliters of calibration standard is dispensed into the chamber, which already contains approximately 500 microliters of buffer. The sensor response increases until it reaches a plateau, approximately 30 seconds. The reference pump then flushes the chamber for approximately 33 seconds and the sensor response changes to a different value. At this point the instrument calculates the relationship of the known standard to the reference solution and stores this information until another calibration injection is performed. The Buffer Pump then flushes the chamber for approximately 33 seconds and the sensor response decreases to the normal baseline value.

During each subsequent sample cycle, the reference solution is again measured and then internally compared to the reference solution concentration measured during the initial calibration. If a variation exists, the calculation of the sample concentration will be compensated accordingly.

The profile of probe current response is shown in Figure 5.3 (Auto Mode) and Figure 5.4 (Manual mode).



1 - Injection prompted; measure baseline current
2 - Inject 25 microliters of calibration standard
3 - Measure calibrator current and deduct baseline current
4 - Measure reference solution current and deduct baseline current
5 - Calculate calibrator to reference solution ratio and save
6 - Flush chamber with fresh buffer

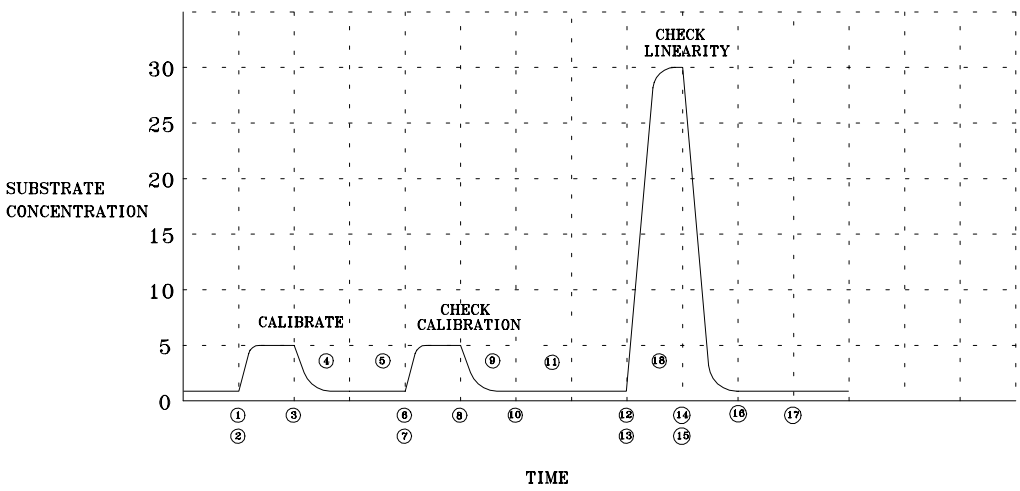
7 - 5 minute window allowed for making cal check injection

8 - Injection prompted; measure baseline current
9 - Inject 25 microliters of calibration standard
10 - Measure sample (calibrator) current and deduct baseline current
11 - Measure reference solution current and deduct baseline current
12 - Calculate sample (calibrator) to reference solution ratio
13 - Divide by original calibrator to reference ratio; multiply by unit constant (5)
14 - Display result and flush chamber with fresh buffer

15 - No fixed requirement for checking linearity, run as a sample

16 - Injection prompted; measure baseline current
17 - Inject 25 microliters of linearity standard
18 - Measure sample (linearity check) current and deduct baseline current
19 - Measure reference solution current and deduct baseline current
20 - Calculate sample (linearity check) to reference solution ratio
21 - Divide by original calibrator to reference ratio; multiply by unit constant (5)
22 - Display result and flush chamber with fresh buffer
23 - Ready for next sample

Figure 5.3 Automatic Mode Probe Current Profile



1 - Injection prompted; measure baseline current
2 - Inject 25 microliters of calibration standard
3 - Measure calibrator current, deduct baseline and save value
4 - Flush chamber with fresh buffer solution

5 - 5 minute window allowed for cal check injection

6 - Injection prompted; measure baseline current
7 - Inject 25 microliters of calibration standard
8 - Measure sample (calibrator) current and deduct baseline current
9 - Flush chamber with fresh buffer solution
10 - Calculate sample to calibrator ratio and display result

11 - No fixed requirement for liearity check, run as a sample

12 - Injection prompted; measure baseline current
13 - Inject 25 microliters of linearity standard
14 - Measure sample (linearity check) current and deduct baseline current
15 - Calculate sample to calibrator ratio and display result
16 - Flush chamber with fresh buffer solution
17 - Ready for next sample

Figure 5.4 Manual Mode Probe Current Profile

5.4 Baseline Stability

The SPORT checks the probe baseline current for stability whenever it enters the Sample mode. The baseline current must be within an acceptable range (less than 6 nanoamps) in order for the instrument to perform to specification. If the baseline current is greater than 6 nA an error message will be displayed, (see Section 9 Troubleshooting.

5.5 Calibration

The SPORT uses one lactate standard (YSI 2327 5 mmol/L) for calibration and two lactate standards are available for checking linearity (YSI 2328 15mmol/L and YSI 1530 30 mmol/L).

The following is the recommended calibration frequency:

Auto Mode

- Every day at the beginning of testing
- Whenever you change the membrane or install new reagent fluids
- Whenever you turn the instrument power on
- Every two hours while testing
- Whenever you change injection devices

Manual Mode

- Every day at the beginning of testing
- Whenever you change the membrane or install new reagent fluids
- Whenever you turn the instrument power on
- For maximum accuracy after every fifth sample
- Whenever you change injection devices

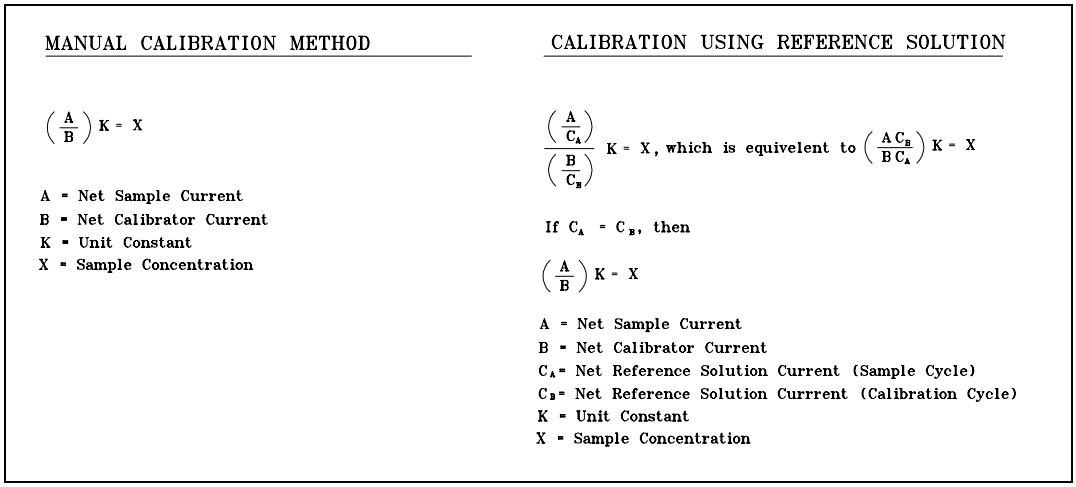


Figure 5.5 Calibration Algorithms

Calibrating the SPORT in Manual Mode with the 5 mmol/L standard basically compares the relative concentration of the standard with the relative concentration of the unknown sample. Calibrating in Automatic Mode compares the relationships of the calibration standard to the reference solution with the relationship of the unknown sample concentration to the reference solution, this

relationship is then used in calculating the final concentration of the sample that is being measured. Refer to Figure 5.5 for the algorithms used.

⚠ WARNING: Running samples with an injection device other than the device used to calibrate the instrument may result in erroneous data.

5.6 Linearity

The sensor consists of an electrode and an enzyme membrane. As the membrane ages, it becomes underlinear, or less sensitive (see Figure 5.6).

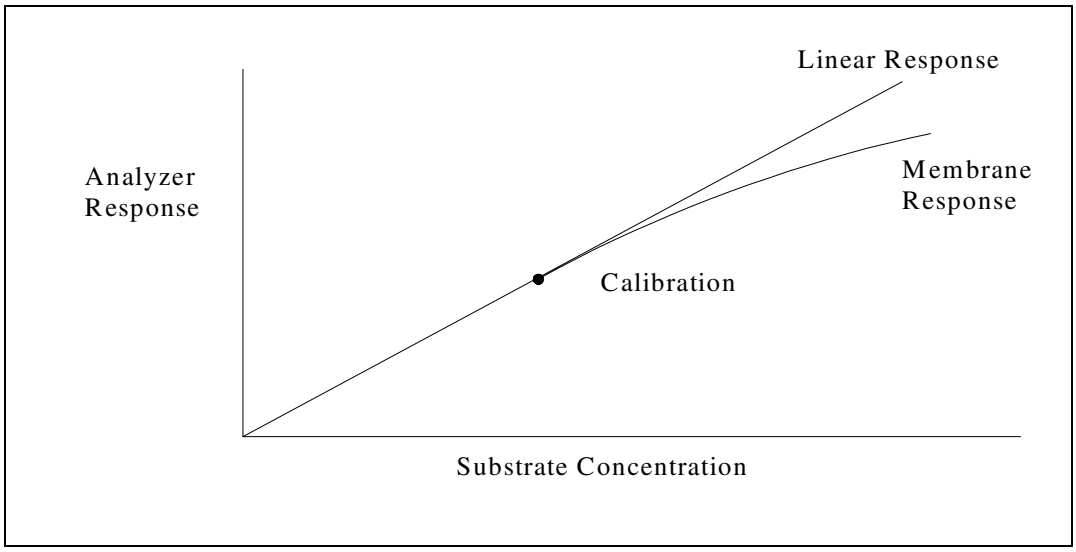


Figure 5.6 Aging Membrane Response

You can check linearity with YSI 1530 30 mmol/L standard, after every calibration. You can also check it at "mid-range" with YSI 2328 15 mmol/L standard. Both standards should be injected as if it were a sample.

Both standards, however, can be measured as samples any time you want to check the linearity manually.

Acceptable Linearity Ranges:

For YSI 2328 Lactate Standard: 14.30 to 15.70 mmol/L
(128.70 to 141.30 mg/dL)

For YSI 1530 Lactate Standard: 28.50 to 31.50 mmol/L
(256.50 to 283.50 mg/dL)

For the very highest accuracy, you should check linearity every hour of use.

5.7 Temperature Compensation

The sensitivity of the sensor varies with temperature changes. The higher the temperature, the more sensitive the sensor becomes. A temperature compensating algorithm has been implemented to adjust for a maximum change of 3 degree Celsius within each sample cycle in auto mode, (Sample temp. vs Reference temp.) or from the most recent calibration in manual mode. If a greater change than this is occurring, the rate of change is too fast to guarantee reliable results. Error checking routines will display an error message if this is the case.

It is reasonable to expect that using the SPORT outside may result in some instances where the temperature rate of change (rising and falling) is quite fast. Please refer to Appendix F–Temperature Effect on Operation for further information about this subject.

5.8 Software Structure

The SPORT incorporates self-test and error detection capabilities to prevent reporting erroneous results.

Microprocessor Self Test

If at initial power up the display does not become active, press the reset button. If this does not correct the problem, try turning the main power switch off and on again. If this does not help, call YSI Technical Support for repair assistance.

Also at power up and prior to each sample cycle, the processor does a fast self test of the electronics to see if any stored data has been corrupted, or if the software has been physically changed. If changes are detected, warning messages will be displayed. Refer to Section 9 Troubleshooting for a listing of the error messages and the possible causes and corrective actions.

Electrode Checks

The background current and noise levels of the electrode are monitored prior to and during both the calibration and sampling cycles. If the error limits are exceeded, an appropriate error message will be displayed. Refer to Section 9 Troubleshooting for a listing of the error messages and the possible causes and corrective actions.

Temperature Error Checks

The sample chamber temperature is checked at several different times during sampling to assure that the rate of change is not adversely affecting result reliability. If the error limits are exceeded, an appropriate error message will be displayed. Refer to Section 9 Troubleshooting for a listing of the error messages and the possible causes and corrective actions.

Battery Level Checks

The battery voltage is checked at several different times during sampling to alert you to conditions that may require reconnecting the battery charger. The software will not allow continuation below certain levels as the stored data can be corrupted if the battery gets to very low levels. Warnings will be displayed at 12.1 volts and a software lockout will occur at 12.0 volts. Once the software lockout is enabled, the battery charger must be connected. This lockout will remain in effect until the battery is recharged to 12.8 volts. A separate electrical hardware shut off will occur at 11.5 volts to prevent any accidental complete discharging of the battery if the SPORT sits unattended for long periods of time. For more information refer to Section 8.8 Recharging the Battery, and Section 9 Troubleshooting for a complete description of the warning messages and corrective actions.

1500 SPORT Menu Flow Chart

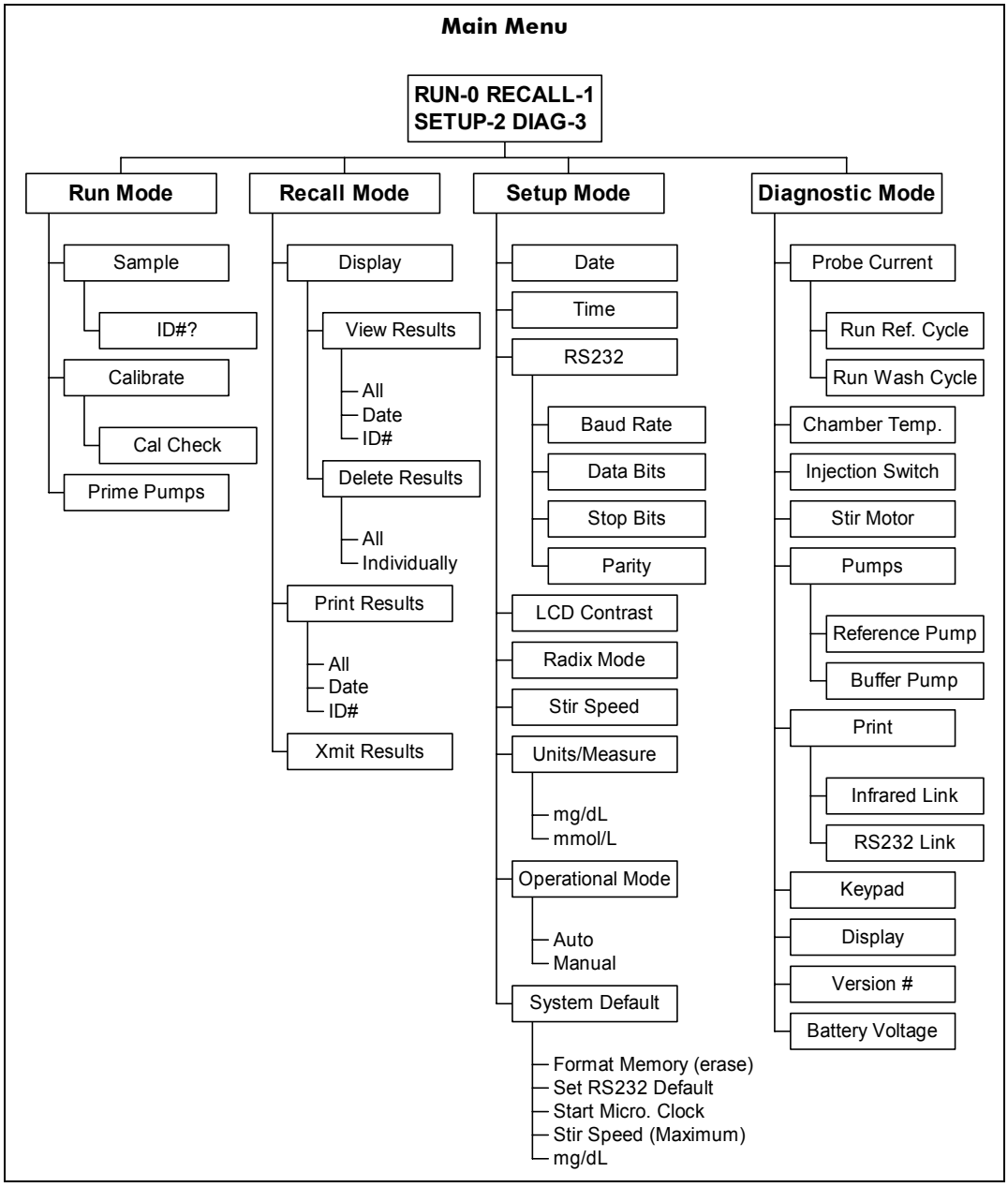


Figure 5.7 Menu Flow Chart

6. Instrument Operation

IMPORTANT: You should check the probe current before beginning tests. (See section 7 Instrument Diagnostics. If there are any problems, you don't want to discover them after you have begun.

Step by step instructions in this chapter will help you learn the operation of the SPORT. Instructions for each step are followed by an illustration of the display as it should respond. If the display does not respond correctly, press **MENU** and try again. It is not uncommon for an instrument to be unstable for the first hour or so once it has been initially setup and calibrated. This is a result of the membrane requiring time to break in and also because the surface of the enzyme probe requires time to condition itself with respect to the new membrane and fluids. **As a result of this YSI recommends that in the first hour of use after initial setup the instrument should be checked several times for accuracy (use YSI standards), and calibrated as often as required.**

6.1 Calibration Cycle

There are two modes of operation allowed on the SPORT, Automatic and Manual mode. Each have their own calibration process which are described in the sections that follow.

Calibration-Automatic Mode

In Automatic mode, you should calibrate the SPORT on these occasions:

- Every day at the beginning of testing
- Whenever you change the membrane or install new reagent fluids
- Whenever you turn the instrument on (automatically prompted)
- Whenever you change injection devices

It is recommended that a sample of the 5 mmol calibration standard should be ran at least once every two hours while testing in order to check calibration status. If the result is outside the specified range, then recalibration is necessary.

Prepare buffer and reference solutions and have the 5 mmol/L, 15 mmol/L and 30 mmol/L calibration standards provided in the 1504 Starter Kit at hand. With the SPORT set up as described in Section 3.3, proceed as follows:

Load the Syringepet or injector with 5 mmol/L standard.

WARNING: If you calibrate with the Syringepet, **measure** with the Syringepet. If you calibrate with the injector, **measure** with the injector. Otherwise, you may get incorrect values.

Press **MENU** until the following display appears.

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Run by pressing **ENTER**.

```
SAMPLE-0
CAL-1 PRIME-2
```

Select the Calibration cycle by pressing **1**, then **ENTER**.

```
WAIT...
```

If the baseline probe current is not within the expected range the display will read:

```
ERROR: BASELINE
PRESS MENU
```

If you see this display press **MENU**, then see Section 9 Troubleshooting.

If there is no problem, the display will read

```
INJECT 5mmol/L
STANDARD...
```

Inject the 5 mmol/L standard. When you remove the injection device, you should see

```
RUNNING...
STIR ON
```

```
RUNNING...
REF ON
```

```
WASHING...
```

If the probe current is outside the expected limits, you will see

ERROR: MEMB SENS

If you see this display press **MENU**, then see Section 9 Troubleshooting.

If there is no problem, the display will read

WAIT...

INJECT 5 mmol CALIBRATOR CHECK

Inject the 5 mmol/L standard to verify a successful calibration. Now you should see

RUNNING... STIR ON

RUNNING... REF ON

WASHING...

CAL CHECK XX.XXmmol

The acceptable range is from 4.90 to 5.10 mmol/L (44.1 to 45.9 mg/dL). If the result is outside of this range, repeat the calibration process in order to eliminate the possibility of improper injection technique. If the calibration was successful press **MENU**.

SAMPLE-0 CAL-1 PRIME-2

Check the linearity of the membrane by injecting a sample of either the YSI 2328 15 mmol or the YSI 1530 30 mmol lactate standard.

Press **ENTER**, the display will read...

```
ENTER ID# XXX
```

No ID# is required so press **ENTER**, the display will read...

```
WAIT...
```

```
INJECT SAMPLE...
```

Inject the sample. When you remove the Syringepet or Injector, you will see

```
RUNNING...
STIR ON
```

```
RUNNING...
REF ON
```

```
#XXX XX.XXmmol/L
WASHING...
```

```
MM/DD/YY HH:MM
#XXX XX.XXmmol/L
```

The sample result will be displayed along with the ID# (in this case 000), date and time.

Linearity failure means that the instrument is not performing to specifications at the upper limit of the dynamic range. This could be due to poor membrane performance, check the date the membrane was installed to verify that it has not expired, (also verify that the membrane has not been subjected to drying out as a result of no fluid in the sample chamber). The acceptable ranges are:

15 mmol: 14.30 to 15.70 mmol (128.3 to 141.7 mg/dL)

30 mmol: 28.50 to 31.50 mmol (256.5 to 283.5 mg/dL)

If the result is not within these ranges, replace the membrane, allow time for it to break in and repeat the calibration process.

If the result is acceptable press **MENU** and the display will read

```
SAMPLE-0
CAL-1 PRIME-2
```

You are now ready to measure samples.

Calibration-Manual Mode

In Manual Mode, you should calibrate the SPORT on these occasions:

- Every day at the beginning of testing
- Whenever you change the membrane or install new reagent fluids
- Whenever you turn the instrument on (automatically prompted)
- After every fifth sample
- Whenever you change injection devices
- A 3°C temperature change since the last calibration (automatically prompted)

Prepare buffer and solution and have the 5 mmol/L, 15 mmol/L and 30 mmol/L calibration standards provided in the 1504 Starter Kit at hand. With the SPORT set up as described in Section 3.3, proceed as follows:

Load the Syringepet or injector with 5 mmol/L standard.

⚠ **WARNING:** If you calibrate with the Syringepet, **measure** with the Syringepet. If you calibrate with the injector, **measure** with the injector. Otherwise, you may get incorrect values.

Press **MENU** until the following display appears.

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Run by pressing ENTER.

```
SAMPLE-0
CAL-1 PRIME-2
```

Select the Calibration cycle by pressing **1**, then **ENTER**.

```
WAIT...
```

If the baseline probe current is not within the expected range the display will read:

ERROR: BASELINE PRESS MENU

If you see this display press **MENU**, then see Section 9 Troubleshooting. If there is no problem, the display will read:

INJECT 5mmol/L STANDARD...

Inject the 5 mmol/L standard. When you remove the injection device, you should see:

RUNNING... STIR ON

WASHING...

If the probe current is outside the expected limits, you will see:

ERROR: MEMB SENS

If you see this display press MENU, then see Section 9 Troubleshooting.

If there is no problem, the display will read:

WAIT...

INJECT 5 mmol CALIBRATOR CHECK

Inject the 5 mmol/L standard to verify a successful calibration.

Now you should see:

RUNNING... STIR ON

```
WASHING...
```

```
CAL CHECK
XX.XXmmol
```

The acceptable range is from 4.90 to 5.10 mmol/L (44.1 to 45.9 mg/dL). If the result is outside of this range, repeat the calibration process in order to eliminate the possibility of improper injection technique. If the calibration was successful, press **MENU**.

```
SAMPLE-0
CAL-1 PRIME-2
```

Check the linearity of the membrane by injecting a sample of either the YSI 2328 15 mmol or the YSI 1530 30 mmol lactate standard.

Press **ENTER**, the display will read:

```
ENTER ID# XXX
```

No ID# is required so press **ENTER**, the display will read:

```
WAIT...
```

```
INJECT SAMPLE...
```

Inject the sample. When you remove the Syringepet or Injector, you will see:

```
RUNNING...
STIR ON
```

```
#XXX XX.XXmmol/L
WASHING...
```

MM/DD/YY HH:MM #XXX XX.XXmmol/L

The sample result will be displayed along with the ID#, date and time.

Linearity failure means that the instrument is not performing to specifications at the upper limit of the dynamic range. This could be due to poor membrane performance, check the date the membrane was installed to verify that it has not expired, (also verify that the membrane has not been subjected to drying out as a result of no fluid in the sample chamber). The acceptable ranges are:

15 mmol: 14.30 to 15.70 mmol (128.3 to 141.7 mg/dL)

30 mmol: 28.50 to 31.50 mmol (256.5 to 283.5 mg/dL)

If the result is not within these ranges, replace the membrane, allow time for it to break in and repeat the calibration process. If the result is acceptable press **MENU** and the display will read:

SAMPLE-0 CAL-1 PRIME-2

You are now ready to measure samples.

6.2 Sample Cycle

With the SPORT calibrated as described, you can proceed to measure lactate values in blood samples or plasma.

⚠ **WARNING:** If you calibrate with the Syringepet, **measure** with the Syringepet. If you calibrate with the injector, **measure** with the injector. Otherwise, you may get incorrect values.

REMEMBER: The Reference solution is only used in Auto mode. The following sample cycle is illustrated as if the reference solution were indeed being used. If you are operating in Manual mode ignore the messages relative to the Reference solution. Press the **MENU** key until the Main menu appears:

RUN-0 RECALL-1 SETUP-2 DIAG-3

Select Run by pressing **ENTER**.

SAMPLE-0 CAL-1 PRIME-2

Select the Sample cycle by pressing **ENTER**.

The memory is limited to 150 results. You can continue to run samples while the memory is full, but the results will not be saved. Stored results will have to be deleted in order to make room available. The procedure for deleting stored results is described later in this section. If the memory is full, the display will read:

```
MEMORY FULL
STOP-0 PROCEED-1
```

Selecting Proceed will allow you to run the sample, but remember that the result will not be stored. If you continue the display will read:

```
ENTER ID# XXX
```

When the "ID" display appears, enter the ID as a three digit number (example: one is entered as 001; two hundred and thirteen as 213), then press **ENTER**, and this display will appear:

```
WAIT...
```

If the probe current is not within the expected range, you will see this display:

```
ERROR: BASELINE
PRESS MENU
```

If you see this display press **MENU**, then see Section 9 Troubleshooting.

If there is no problem, the display will read...

```
INJECT SAMPLE...
```

Inject the sample. When you remove the Syringepet or Injector, you will see

```
RUNNING...
STIR ON
```

```
RUNNING...
REF ON
```

If the concentration of the sample exceeds the measurable limits of the instrument, the following message will appear:

```
ERROR: OVERRANGE
WASHING...
```

If you see this display, no result will be stored or displayed, press MENU and refer to Section 9 Troubleshooting.

If there is no problem, the display will read

```
#XXX XX.XXmmol/L
WASHING...
```

```
MM/DD/YY HH:MM
#XXX XX.XXmmol/L
```

The sample result will be displayed along with the ID#, date and time.

Press **MENU** to return to the Run menu. The previous result, ID#, date and time, will be stored in memory until it is deleted

```
SAMPLE-0
CAL-1 PRIME-2
```

6.3 Recalling Stored Results

The SPORT allows you to recall any stored result. Results may be recalled by ID#, by date, or all results may be recalled in chronological order. The following sections identify the different ways to do this.

Recalling All Sample Results

Go to the Main menu by pressing **MENU** until the display reads

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Recall by pressing **1**, then **ENTER**.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

To select viewing the results on the display press **ENTER**.

```
DISPLAY-0
DELETE ALL-1
```

To select viewing the results on the display press **ENTER**.

```
LIST ALL-0
BY: DATE-1 ID-2
```

Select List All by pressing **ENTER**.

Press **ENTER**. The first sample result stored will appear.

```
MM/DD/YY HH:MM
#XXX X.XXmmol/L
```

Every time you press **ENTER**, the next value stored will be displayed. You can cycle, step by step, through all of the results stored in memory. The date, time ID number will change as necessary to match each sample.

When all of the results have been displayed you will see this display:

```
NO SAMPLES
PRESS MENU
```

NOTE: It is possible to end the result recall at any point by pressing **MENU**.

Recalling Today's Sample Results

Go to the Main menu by pressing **MENU** until the display reads

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Recall by pressing **1**, then **ENTER**.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

To select viewing the results on the display press **ENTER**.

```
DISPLAY-0
DELETE ALL-1
```

To select viewing the results on the display press **ENTER**.

```
LIST ALL-0
BY: DATE-1 ID-2
```

Select Date by pressing **1**, then **ENTER**.

```
DATE MM/DD/YY
XX/XX/XX
```

NOTE: The current date is what will appear on the display.

Press **ENTER**. The first sample result stored today will appear.

```
MM/DD/YY HH:MM
#XXX X.XXmmol/L
```

Every time you press **ENTER**, the next value stored will be displayed. You can cycle, step by step, through all of the results on this date. The ID number will change as necessary to match each sample.

When all of the results have been displayed you will see this display:

```
NO SAMPLES
PRESS MENU
```

NOTE: It is possible to end the result recall at any point by pressing **MENU**.

Recalling a Result From Any Previous Date

Go to the Main menu.

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Recall by pressing **1**, then **ENTER**.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

To select viewing the results on the display press **ENTER**.

```
DISPLAY-0
DELETE ALL-1
```

To select viewing the results on the display press **ENTER**.

```
LIST ALL-0
BY: DATE-1 ID-2
```

Select Date by pressing **1**, then **ENTER**.

```
DATE MM/DD/YY
XX/XX/XX
```

NOTE: Today's date will appear. Key in a date as described in Section 3.6 System Setup, then press **ENTER**.

Example: January 17, 2003 is entered as **01 17 03 ENTER**

The first sample result stored in memory on that date will be displayed.

```
MM/DD/YY HH:MM
#XXX X.XXmmol/L
```

Every time you press **ENTER**, the next result stored will be displayed. You can cycle, step by step, through all of the results on this date. The ID number will change as necessary to match each sample.

When all of the results have been displayed you will see this display:

```
NO SAMPLES
PRESS MENU
```

NOTE: It is possible to end the result recall at any point by pressing **MENU**.

Recalling a Result By ID Number

Go to Main menu by pressing the **MENU** key until the display reads.

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Recall by pressing **1**, then **ENTER**.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

To select viewing the results on the display press **ENTER**.

```
DISPLAY-0
DELETE ALL-1
```

To select viewing the results on the display press **ENTER**.

```
LIST ALL-0
BY: DATE-1 ID-2
```

Select ID by pressing **2**, then **ENTER**.

```
ENTER ID# XXX
```

Enter the desired ID as a three digit number, from left to right, then press **ENTER**.

The first sample result stored in memory that has the number you've entered will be displayed.

```
M/DD/YY HH:MM
#XXX X.XXmmol/L
```

Every time you press **ENTER**, the next result stored will be displayed. You can cycle, step by step, through all of the results with this ID#. The date and time will change as necessary to match each sample.

When all of the results have been displayed you will see this display:

```
NO SAMPLES
PRESS MENU
```

NOTE: It is possible to end the result recall at any point by pressing **MENU**.

When you are finished, press **MENU** until the Main menu appears.

6.4 Printing Results

It is possible to print out results as you are running samples. This is possible because the SPORT sends all of the result data over the infrared data link automatically at the end of each sample cycle. All that is necessary is that the printer be positioned correctly and turned on. Refer to Figure 3.6 to determine printer positioning and alignment.

The following sections describe the actions required to print stored results.

Printing All Sample Results

Go to Main menu by pressing the **MENU** key until the display reads.

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Recall by pressing **1**, then **ENTER**.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

Select Print by pressing **1**, then **ENTER**.

```
PRINT ALL-0
BY: DATE-1 ID-2
```

To print all results in memory, press **ENTER**. The display will be active during the printing process showing each result as it is printed. **It is not possible to halt the printing once it has started.** Once finished the display will return to the RECALL menu.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

Use the **MENU** key to return to the Main menu.

NOTE: The printer must be placed in the correct position and turned on in order to receive the data. Refer to Figure 3.6 for the printer placement if you are unsure.

Printing Today's Results

Go to Main menu by pressing the **MENU** key until the display reads.

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Recall by pressing **1**, then **ENTER**.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

Select Print by pressing **1**, then **ENTER**.

```
PRINT ALL-0
BY: DATE-1 ID-2
```

Select Date by pressing **1**, then **ENTER**.

```
DATE MM/DD/YY
XX/XX/XX
```

NOTE: The current date is what will appear on the display.

Press **ENTER**. The display will be active during the printing process showing each result as it is printed. **It is not possible to halt the printing once it has started.** Once finished the display will return to the RECALL menu.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

Use the **MENU** key to return to the Main menu.

Printing Previous Days' Results

Open the Main menu.

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Recall by pressing **1**, then **ENTER**.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

Select Print by pressing **1**, then **ENTER**.

```
PRINT ALL-0
BY: DATE-1 ID-2
```

Select Date by pressing **1**, then **ENTER**.

```
DATE MM/DD/YY
XX/XX/XX
```

NOTE: Today's date will appear. Key in a date as described in Section 3.6 System Setup, then press **ENTER**.

Example: January 17, 1998 is entered as **01 17 98 ENTER**

The display will be active during the printing process showing each result as it is printed. **It is not possible to halt the printing once it has started.** Once finished the display will return to the RECALL menu.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

Use the MENU key to return to the Main menu.

Printing Results By ID Number

Go to the Main menu.

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Recall by pressing **1**, then **ENTER**.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

Select Print by pressing **1**, then **ENTER**.

```
PRINT ALL-0
BY: DATE-1 ID-2
```

Select ID by pressing **2**, then **ENTER**.

```
ENTER ID# XXX
```

Enter the desired ID as a three digit number, from left to right, then press **ENTER**.

The display will be active during the printing process showing each result as it is printed. **It is not possible to halt the printing once it has started.** Once finished the display will return to the RECALL menu.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

Use the **MENU** key to return to the Main menu.

6.5 Transmitting Results Over the RS232 Communication Link.

NOTE: Be sure all the communication parameters have been set correctly. Refer to Section 3 Instrument Setup.

Go to the Main menu.

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Recall by pressing **1**, then **ENTER**.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

Select XMIT by pressing **2**, then **ENTER**.

The display will be active during the transmitting process, flashing each result as it is transmitted. All stored data will be transmitted and **it is not possible to halt the process once it has started.** Once finished the display will return to the RECALL menu.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

Use the **MENU** key to return to the Main menu.

6.6 Deleting Stored Results

There are two ways to delete results that have been stored in memory. The first method described edits out results no longer required. This method requires that the result that is to be deleted be recalled on the display to make sure that the correct result is deleted.

The second method deletes all results.

Editing Results

Go to the Main menu by pressing **MENU** until the display reads

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Recall by pressing **1**, then **ENTER**.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

To select viewing the results on the display press **ENTER**.

```
DISPLAY-0
DELETE ALL-1
```

To select viewing the results on the display press **ENTER**.

```
LIST ALL-0
BY: DATE-1 ID-2
```

The results that need to be deleted can be displayed by date, by ID#, or all the results may be displayed. To delete the displayed result, press the **DELETE** key and the result will be deleted from the memory. The display will then step to the next result. If you do not wish to delete this result, press **ENTER** and the next result will be displayed.

Deleting All Results

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Recall by pressing **1**, then **ENTER**.

```
SAMPLES LCD-0
PRINT-1 XMIT-2
```

To select viewing the results on the display press **ENTER**.

```
DISPLAY-0
DELETE ALL-1
```

To delete all of the stored results press **1**, then **ENTER**.

```
ARE YOU SURE?
NO-0 YES-1
```

To delete all results press **1**, then **ENTER**. The display will read

```
RESULTS DELETED
"PRESS MENU"
```

If you chose not to delete all the results, pressing **MENU** will return you to the previous menu. Pressing **ENTER** will display

```
RESULTS OK
"PRESS MENU"
```

Press **MENU** to return to the Main menu.

6.7 Daily Operational Checks

To assure that your SPORT is operating properly, check the membrane integrity and the linearity every day.

We recommend that you keep an instrument logbook in which dates and lot numbers of reagents are recorded, along with a record of daily operational checks and other relevant information.

Membrane Integrity Test

Use YSI 2363 Potassium Ferrocyanide (FCN) to determine if your membranes are intact. This solution is packaged in your starter kit, and may also be ordered separately. With the instrument in SAMPLE mode, inject 25 microliters of the solution with whichever injection device was used for calibration.

The reading should be below 0.3 mmol/L (2.7 mg/dL). If it is greater, repeat the test. If it's still too high, change the membrane.

Linearity Test

Use YSI 1530 30 mmol/L or YSI 2328 15 mmol/L Lactate Standard to check the linearity of the sensor. These standards are packaged in your starter kit, and also may be ordered separately.

Acceptable Ranges:

YSI 2328 14.30 to 15.70 mmol/L (128.3 to 141.7 mg/dL)

YSI 1530 28.50 to 31.50 mmol/L (256.5 to 283.5 mg/dL)

7. Instrument Diagnostics

Diagnostic routines in the software provide troubleshooting capability not only in manufacturing, but also in field service and user maintenance.

These routines check the following elements of the electronic and fluid systems.

- Probe current. Buffer and reference fluid cycles are independently accessible to monitor probe current change.
- Sample chamber temperature
- Injection switch status
- Motors. The pump motors and stir motor can be run separately or simultaneously.
- RS232. A test data string is sent over the serial communications link.
- Printer. A print test form is sent over the infrared data link.
- Keypad. Each key can be verified for performance.
- Display. A diagnostic routine checks every LCD segment for failure.
- Battery. Battery voltage can be monitored on the display.

7.1 Checking Probe Current

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Diagnostics by pressing **3**, then **ENTER**.

```
PROBE-0 TEMP-1
INJ SW-2 MORE-3
```

Select Probe by pressing **ENTER**.

```
PROBE-0
REF-1 BUF-2
```

To display the probe current, press **ENTER.** The display will read:

```
WAIT...
```

```
PROBE X.XX nA
```

The display will update every few seconds. To leave this condition, press **MENU.** The display will read:

```
PROBE-0
REF-1 BUF-2
```

You can also run either the reference or buffer pumps and monitor the change in probe current. To do this press the desired numerical key and then **ENTER**, the display will read:

```
PROBE X.XX nA
```

The display will update every few seconds. To leave this mode, press **MENU**.

```
PROBE-0
REF-1 BUF-2
```

Press **MENU** until main menu appears.

7.2 Checking Sample Chamber Temperature

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Diagnostics by pressing **3**, then **ENTER**.

```
PROBE-0 TEMP-1
INJ SW-2 MORE-3
```

Select Temperature by pressing **1**, then **ENTER**. The display will show the current chamber temperature.

```
CHAMBER TEMP XX.XX
C
```

Press **MENU** to return to the Main menu.

7.3 Checking the Sample Chamber Injection Switch Status

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Diagnostics by pressing **3**, then **ENTER**.

```
PROBE-0 TEMP-1
INJ SW-2 MORE-3
```

Select Injection Switch by pressing **2**, then **ENTER**.

```
INJECTION SWITCH
OFF
```

Inserting an injection device will trigger the switch and the change in state will be indicated (ON / OFF) on the display. Press **MENU** to return to the Main menu.

7.4 Turning the Stir Motor On and Off

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Diagnostics by pressing **3**, then **ENTER**.

```
PROBE-0 TEMP-1
INJ SW-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
STIR-0 PUMPS-1
PRINT-2 MORE-3
```

Select Stir by pressing **ENTER**.

```
STIR OFF-0 ON-1
```

Turn the stir motor on or off by pressing the appropriate number key and then **ENTER**. Press **MENU** to return to the Main menu.

7.5 Turning Pump Motors On and Off

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Diagnostics by pressing **3**, then **ENTER**.

```
PROBE-0 TEMP-1
INJ SW-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
STIR-0 PUMPS-1
PRINT-2 MORE-3
```

Select Pumps by pressing **1**, then **ENTER**. The display will read:

```
BUF OFF-0 ON-1
REF OFF-2 ON-3
```

Turn the pump motors on or off by pressing the appropriate number key and then **ENTER**. Press **MENU** to return to the Main menu.

7.6 Sending a Test Print String Over the Infrared Data Link

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Diagnostics by pressing **3**, then **ENTER**.

```
PROBE-0 TEMP-1
INJ SW-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
STIR-0 PUMPS-1
PRINT-2 MORE-3
```

Select Print by pressing **2**, then **ENTER**.

```
TEST PRINT-0
TEST RS232-1
```

Press **ENTER** to send a test form over the infrared data link.

```
PRINTING…
```

```
TEST PRINT-0
TEST RS232-1
```

Press **MENU** to return to the Main menu.

7.7 Sending a Test Data String Over the RS232 Data Link

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Diagnostics by pressing **3**, then **ENTER**.

```
PROBE-0 TEMP-1
INJ SW-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
STIR-0 PUMPS-1
PRINT-2 MORE-3
```

Select Print by pressing **2**, then **ENTER**.

```
TEST PRINT-0
TEST RS232-1
```

Press **1**, then **ENTER** to send a test data string over the RS232 data link.

```
XMITTING…
XXXXXXXXXXXXXX
```

```
TEST PRINT-0
TEST RS232-1
```

Press **MENU** to return to the Main menu.

7.8 Testing the Keypad

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Diagnostics by pressing **3**, then **ENTER**.

```
PROBE-0 TEMP-1
INJ SW-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
STIR-0 PUMPS-1
PRINT-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
KEYS-0 DISPLAY-1
VER #-2 MORE-3
```

Select Keys by pressing **ENTER**. The display will be empty except for the cursor in the upper left hand corner. The display will now respond to each key pressed by showing the description of the key on the display. Press **MENU** to return to the Main menu.

7.9 Testing the Display

Go to Main menu by pressing **MENU** until you see:

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Diagnostics by pressing **3**, then **ENTER**.

```
PROBE-0 TEMP-1
INJ SW-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
STIR-0 PUMPS-1
PRINT-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
KEYS-0 DISPLAY-1
VER #-2 MORE-3
```

Press **1**, then **ENTER** to initiate the display test routine. Pressing **CANCEL** will halt the test at any time. The test routine consists of displaying multiple character sets at three different contrast settings and also lighting every LCD segment.

Press **MENU** to return to the Main menu.

7.10 Checking the Software Version Number

It will be necessary to communicate the software version number to a service technician if a call is required. Press **MENU** until you return to the Main menu.

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Diagnostics by pressing **3**, then **ENTER**.

```
PROBE-0 TEMP-1
INJ SW-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
STIR-0 PUMPS-1
PRINT-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
KEYS-0 DISPLAY-1
VER #-2 MORE-3
```

Select Version by pressing **2**, then **ENTER**. The software version number will be displayed.

```
VERSION X.XX LAC
PRESS MENU
```

Press **MENU** to return to the Main menu.

7.11 Checking the Battery Voltage

To display the "non-loaded" battery voltage, press **MENU** until you return to the Main menu.

The "loaded" voltage will typically be about 0.06 volt less.

```
RUN-0 RECALL-1
SETUP-2 DIAG-3
```

Select Diagnostics by pressing **3**, then **ENTER**.

```
PROBE-0 TEMP-1
INJ SW-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
STIR-0 PUMPS-1
PRINT-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
KEYS-0 DISPLAY-1
VER #-2 MORE-3
```

Select More by pressing **3**, then **ENTER**.

```
BATTERY-0
```

Press **ENTER** to display the **non-loaded** battery voltage.

```
BATTERY XX.XX
XX
```

The display will update every few seconds. Press **MENU** to return to the Main menu. The number on the bottom line is the number of times the battery voltage reading is updated and will clear automatically when leaving this menu.

Note: Typically the loaded voltage at which the actual battery checks are done is lower by 0.10 volts.

8. Maintenance

Turn the instrument power off during maintenance. This will prevent any accidental activation of the fluid pumps which could cause spills or air in the tubing.

8.1 Daily Maintenance

Certain procedures are to be followed each day that the SPORT is in use.

Empty the Waste Bottles

WARNING: The waste contents of the SPORT are considered a biohazard and must be disposed of accordingly. The waste bottle should be cleaned with a disinfecting agent. The reagents used in the instrument are non-toxic and consist of a phosphate salt buffer, lactate standards and the detergent Triton X-100.

Check Buffer and Reference Bottle Levels

The SPORT does not sense fluid levels automatically, so you have to look to see that you have enough. If you run out and don't realize it, you'll get wrong data and you may lose samples.

Replace the Buffer and Reference solutions if they are low or have been in the instrument longer than a week. Follow the instructions in Section 3.3 Reagent Preparation.

After a solution change, prime the fluid system. Select **RUN-0** from the Main menu. Selecting **PRIME-2** will run predetermined amounts of reference and buffer solutions in order to fill all the supply lines completely.

NOTE: There is usually air in the waste tubing. This does not affect performance.

Check for Air Bubbles in Chamber

Examine the sample chamber for any air bubbles that may have stuck to the membrane and/or stir bar. Bubbles that do not flush out of the chamber can give you artificially high lactate readings. Refer to Section 9 Troubleshooting for directions in removing air bubbles.

Check for Leaks

Examine the tubing for leaks and check the sample chamber for large air bubbles, which may be caused by either loose connections or worn pump tubing. Refer to Section 8.6 Tubing Replacement if the tubing needs to be replaced.

Clean up spills

Spills should be cleaned up immediately to prevent corrosion and biohazard buildup. Blood spills must be carefully and safely removed. If there is any evidence of salt build-up around the sample chamber, disassemble and clean the chamber as described in Section 8.3.

8.2 Preventative Maintenance

The YSI 1503 Preventative Maintenance Kit contains all the supplies necessary to keep your SPORT operating properly. Perform all the maintenance procedures in Section 8.3 through 8.7 every 6 months, or as required.

IMPORTANT: The Waste bottles, both reagent bottles, the 500mL mixing bottle and the 3cc Syringe provided in the YSI 1504 Starter Kit should be cleaned every week with a disinfecting agent. The bottles and Syringe should be rinsed completely with distilled water after cleaning to remove any disinfecting residue, which would cause membrane failure if it got into the system.

8.3 Cleaning the Sample Chamber

Clean the sample chamber every month.

Unscrew the probes from their housings. If the membrane has passed the tests in Section 6.7, you don't have to replace it, but you shouldn't let it dry out. If the chamber is off the instrument for more than 15 minutes, the membrane should be replaced.

Disconnect the supply and waste line tubing from the fittings on the sample chamber manifold.

Remove the two screws securing the injection block to the top of the sample chamber and move it to one side. Remove the 2 screws securing the sample chamber to the case panel.

Remove the screw holding the manifold to the chamber. Be careful not to lose the two O-rings that seal the connection. Replace them if necessary.

Be careful not to discard the small magnetic stir bar. An extra one is supplied in your maintenance kit. Clean the chamber with the appropriate disinfecting agent, then flush it with copious amounts of warm water, followed by a distilled water rinse.

Reassemble the chamber and manifold and attach the assembly to the case panel. Reattach the injection block to the top of the sample chamber.

Remember to return the stir bar to the chamber. Install new O-rings or a new membrane if necessary, and install the probes. Extra O-rings are supplied in your Preventative Maintenance Kit.

8.4 Membrane Replacement

To assure proper performance and prevent unexpected downtime, we recommend that you replace lactate membranes every 14 days. See Section 3.4 for membrane replacement procedure.

8.5 Probe Cleaning

With normal use, enzyme sensors may become fouled and cease to operate in a normal mode. A fouled sensor's output current will decrease and calibration may become unstable.

Since the severity of fouling will vary, listed below are methods of cleaning which should be matched to the cleaning needs. Follow the steps carefully and in order.

Sensor Maintenance

It is necessary to maintenance the enzyme sensor when the 1503 PM kit is installed and periodically as needed.

1. Remove the enzyme membrane and hold the probe with the electrodes facing up.
2. Wad a small portion of a lint free tissue and wet it with 70% isopropyl alcohol.
3. Using your thumb, press the alcohol soaked wad against the probe's surface and rotate the probe back and forth.
4. Rinse the sensor with reagent grade water and return the sensor to normal service.

Sensor Cleaning and Reconditioning

The following procedure is recommended to be used only when the enzyme sensor stops operating normally and the above maintenance procedure is ineffective. This is not a routine maintenance procedure.

1. With the membrane removed, immerse the sensor in a 14% solution of ammonia for 3 minutes.
2. Immediately after soaking, rinse the sensor with reagent grade water for 3-5 minutes. It is important that all the residual ammonia is removed.

3. Prepare a small amount of 0.5% sodium hypochlorite solution.
4. Immerse the sensor in the solution for 30 - 45 seconds. Check periodically...sensor should darken, but do not allow it to become black.
5. Remove the sensor and immediately rinse it with reagent water for at least 2 minutes.
6. Install a new membrane and return the probe to service.

The procedure below is only recommended as a last resort for revitalizing a sensor after the above cleaning procedure has been unsuccessfully attempted.

⚠ WARNING: The following procedure may cause permanent damage to the enzyme sensor.

1. Using a clean new pencil eraser, carefully, rub the center electrode (platinum) of the sensor. Do not rub the epoxy between the two electrodes or the outer silver electrode.
2. To remove any eraser dust or residual, rinse sensor with 70% isopropyl alcohol and then reagent grade water.
3. Prepare a small amount of 0.5% sodium hypochlorite solution.
4. Immerse the sensor in the solution for about 45 seconds.
5. Remove the sensor and immediately rinse it with reagent grade water for at least 2 minutes.
6. Install a new membrane and return the probe to service.

NOTE: Several hours may be required for the sensor to stabilize after cleaning.

8.6 Tubing Replacement

The buffer and reference solutions are moved through the SPORT with peristaltic tubing pumps. Tubing life depends on how much the instrument is used. Replace all of the SPORT tubing at least every 6 months. Any tube that becomes loose at the fittings should be replaced immediately.

Remove the screws holding the buffer and calibrator pump to the case panel. Disconnect and remove all the instrument tubing. New tubing is supplied in the Preventive Maintenance Kit. Connect the new tubing as shown in Figure 8-1. When installing new pump tubing, first thread the tube through the pump head and install the roller assembly (see Figure 8-2). It will help to twist the roller assembly as you install it. It should snap into place. Remount the pump to the case panel. Remember to install the tube bushings on both the inlet and outlet side of the pumps.

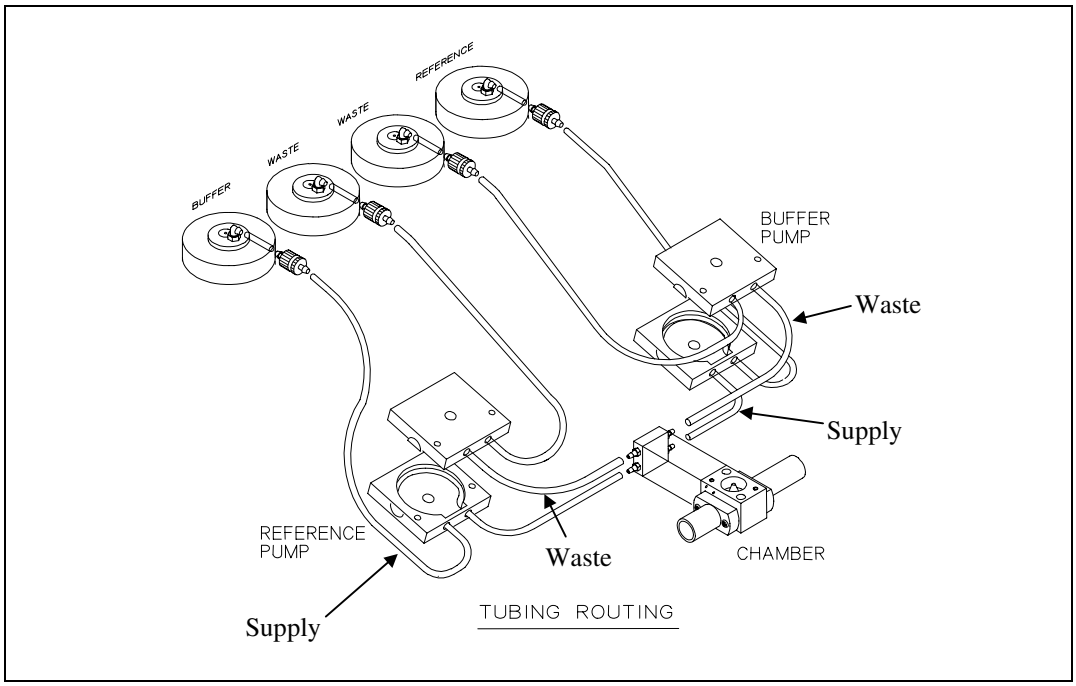


Figure 8-1 SPORT Tubing Routing

WARNING: It is extremely important that the correct size tubing be used for the supply and waste pumps. Switching the two will result in sample chamber overflow.

Supply pump tubing size.....5/32" OD x 1/32" wall

Waste pump tubing size.....3/16" OD x 1/32" wall

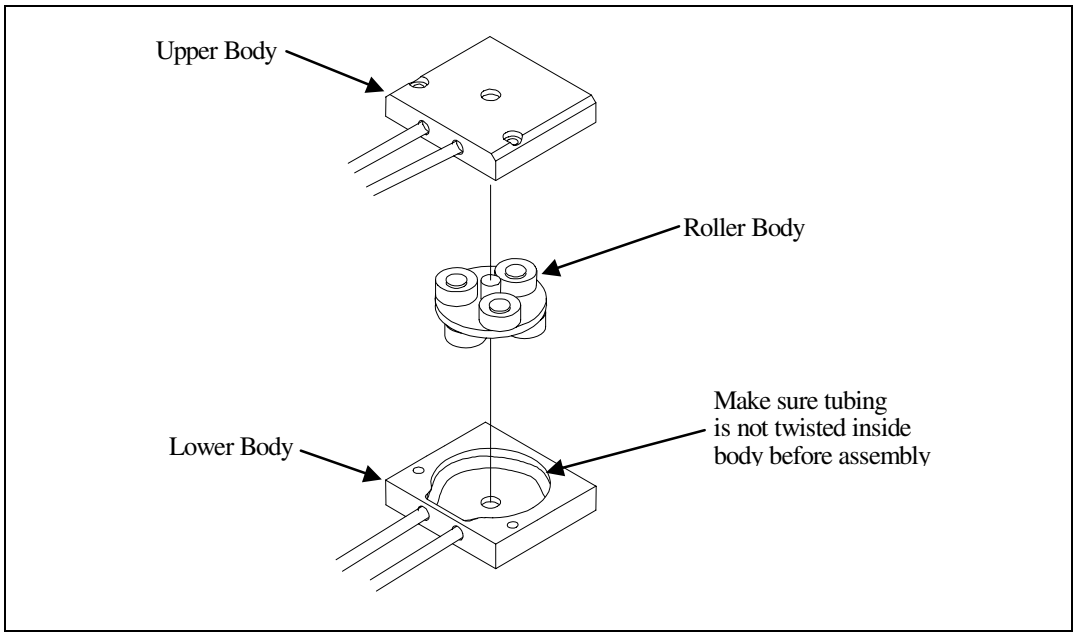


Figure 8-2 SPORT Pump Assembly

8.7 Injection Port Seal Replacement

An injection port seal is included with your instrument. It is used during transportation and long term storage. Replace the plug and O-ring on it every six months, because they can deteriorate and allow chamber fluid leakage. Extra O-rings and plugs are supplied in the Preventative Maintenance Kit.

8.8 Recharging the Battery

A fully charged battery will provide a minimum of 8 hours* operating time. At this time or shortly thereafter a warning will be displayed after each sample cycle alerting you to a "low battery " condition.

To recharge the battery, switch the power off, plug the wall charging unit into an available AC outlet and connect the other end to the instrument interface panel at the Power Receptacle which is labeled CHARGE. The charger is designed to fully charge the SPORT battery over a period of 8 hours, disconnecting the charger prior to this will impact the amount of time available for battery only operation. Once the battery is fully charged, the red indicator lamp on the charger will flicker on and off rapidly. This is the indication that the charger is floating. An overnight charge should be more than adequate to insure a full day of "battery only testing" the next day. The SPORT may be turned back on immediately or left with the power off. The battery will be recharged in either condition. Turning on the power will allow immediate continuation once the probe has restabilized.

⚠ WARNING: Always make sure the sport power is turned off prior to connecting the battery charger. Failure to do this could result in stored data corruption if the battery has been discharged to a very low level.

* Refer to Appendix F–Temperature Effect on Operation for additional information.

8.9 Storing the SPORT

Electrical System

We recommend that while storing the SPORT, you leave the unit on charge. This will guarantee that the next time the SPORT is needed, the battery will be fully charged and ready for a full day of use if necessary. Failure to do this could result in a battery that is incapable of retaining a charge sufficient enough to guarantee 8 hours of use. This is because even though the battery is hardware disconnected at a level of 11.5 volts it is possible due to the normal discharging

of the battery itself that the capacity of the battery will be permanently compromised if the unit remains off charge for several months.

YSI recommends that prior to storing, the battery should be fully charged (8 hours minimum) and the power turned off.

Fluid System

If the SPORT is to be inactive for longer than a week, we recommend that the whole system be flushed completely out with either deionized or distilled water. This will prevent any of the salts that are present in the buffer and reference solutions from crystallizing and blocking the fluid path.

This can be done quite simply by first emptying all of the fluid bottles and then rinsing and filling the supply bottles with distilled or deionized water. The system can then be either cycled using the priming function available in RUN mode, or it may be done through DIAGNOSTICS using the individual functions.

Storage of the unit for less than a week can be done with the buffer and reference fluids in place.

NOTE: It is possible that after a period of storage, depending on the tubing condition, the tubing inside the pump may stick closed preventing fluid flow. Depending on whether it happens to the waste or supply tubing, the chamber may overflow or it simply may not fill correctly when attempting to run the unit for the first time. Should either of these things happen, refer to Section 9 Troubleshooting, for instructions on how to correct the problem.

9. Troubleshooting

This section deals with identifying and correcting problems that interfere with the performance of the SPORT. The fault messages that the instrument may display are listed, then a brief explanation of the fault is given. Following each fault is a list of possible causes with recommended corrective actions.

It is important that a systematic approach is taken to identifying the cause of an instrument failure. The first step is to accumulate as much pertinent information as possible.

- Review the printed reports for trends in data and errors. (This is only possible if the optional printer is being used while running samples. Refer to Section 3.8 Printer Option, for an explanation of the printed format.)
- Check reagent and membrane installation dates. Compare the elapsed times with the recommended times.
- Look and listen for problems (unusually noisy components, loose connections, fluid leaks, air bubbles in the sample chamber, salt build-ups, etc.).
- Review Section 7 Instrument Diagnostics to become familiar with testing individual components of the SPORT.
- Use the troubleshooting chart in this section to assist you in identifying the problem, then use the chart to guide you to a corrective action.

If the problem cannot be resolved, contact YSI Customer Service (address and phone number in Appendix I–Warranty and Shipping Information). When communicating with service personnel, please indicate the serial number of the instrument and if necessary the accessory products. If writing or transmitting a FAX for assistance, please include a thorough description of the problem(s) and copies of the printed reports if possible.

If it becomes necessary to return the instrument to YSI for servicing please refer to Appendix I–Warranty and Shipping Information for instructions.

9.1 Fault Messages

Data System Faults

```
ROM IS NEW
PRESS ENTER
```

An internal test of the most recent and current EPROM checksum data is done and if there is a discrepancy this message is displayed. This fault is generated when the software has been replaced with a different version. Pressing **ENTER** will display the following message.

```
OK TO LOSE DATA
NO- 0 YES -1
```

Two options exist at this point, one is to select NO, save your data and decide not to continue. Choosing this option will display the following:

```
POWER DOWN
CONSULT MANUAL
```

We recommend at this point that you contact YSI Customer Service as this is a system failure that may require returning the instrument.

The second option is to select YES which will reformat the SPORT memory. The software will attempt to correct itself but in doing so ALL stored data will be lost. If YES was selected, the stir speed, date and time must also be reset. Refer to Section 3 Instrument Setup for more information if necessary.

IMPORTANT: Any previously stored sample results will be permanently erased by selecting YES.

```
BAD SYS VARS
PRESS ENTER
```

A check is done of all data system variables after each sample cycle, if there is a discrepancy this message will be displayed.

```
OK TO LOSE DATA?
NO -0 YES -1
```

Two options exist at this point, one is to select NO and save your data and decide not to continue. Choosing this option will display the following:

```
POWER DOWN
CONSULT MANUAL
```

We recommend at this point that you contact YSI Customer Service as this is a system failure that may require returning the instrument.

The second option is to select YES which will reformat the SPORT memory. The software will attempt to correct itself but in doing so ALL stored data will be lost. If YES was selected, the stir speed, date and time must also be reset. Refer to Section 3 Instrument Setup for more information if necessary.

IMPORTANT: Any previously stored sample results will be permanently erased by selecting YES.

```
BAD RAM DATA
PRESS ENTER
```

A check is done of all stored data after each sample cycle, if there is a discrepancy this message will be displayed.

```
OK TO LOSE DATA?
NO -0 YES -1
```

Two options exist at this point, one is to select NO and save your data and decide not to continue. Choosing this option will display the following:

```
POWER DOWN
CONSULT MANUAL
```

We recommend at this point that you contact YSI Customer Service as this is a system failure that may require returning the instrument.

The second option is to select YES which will reformat the SPORT memory. The software will attempt to correct itself but in doing so ALL stored data will be lost. If YES was selected, the stir speed, date and time must also be reset. Refer to Section 3 Instrument Setup for more information if necessary.

IMPORTANT: Any previously stored sample results will be permanently erased by selecting YES.

```
INJECT TIMEOUT
PRESS MENU
```

This message will be displayed if, after being prompted to inject either a calibrator or a sample, 5 minutes passes.

Pressing **MENU** will move you to the previous menu from where you will be allowed to continue once more.

Battery Faults

LOW BATTERY
PRESS ON

A check of the battery voltage is done during the sample cycle. At 12.1 volts this message is displayed. Sampling will not be prohibited at this point, typically there is enough battery reserve at this point to continue for at least 1 hour of continuous testing (minimum of 40 samples). Press the **ON** key to clear the message and allow operation of the instrument.

CONNECT CHARGER
PRESS ON

This message is displayed when the level drops below 12.0 volts. At this point in order to continue you must connect the battery charger. The software will not allow you to continue sampling though until the battery has been recharged to a level of 12.8 volts. This is done to protect the discharge/recharge capacity of the battery and insure the maximum amount of good usable battery life.

Enzyme Sensor Faults

ERROR: BASELINE
PRESS MENU

This fault is generated because the probe baseline current is above the allowable starting point of 6 nanoamps. It is common to see this fault if you try to run samples too soon after turning the instrument on or after putting on a new membrane. Remember that new membranes need time to break in.

- POSSIBLE CAUSE: Reference solution in sample chamber.
- CORRECTIVE ACTION: Enter PROBE diagnostics and cycle the buffer pump.
- SECTION: 7.1

- POSSIBLE CAUSE: Tubing routed incorrectly through peristaltic pumps.
- CORRECTIVE ACTION: Check tubing routing and verify fluid flow path.
- SECTION: 8.6

- POSSIBLE CAUSE: A sample has been injected into the sample chamber at the improper time.
- CORRECTIVE ACTION: Enter PROBE diagnostics and cycle the buffer pump.
- SECTION: 7.1

- POSSIBLE CAUSE: Pinched, plugged, leaking or disconnected tubing.
- CORRECTIVE ACTION: Fix or replace tubing.
- SECTION: 8.6

- POSSIBLE CAUSE: Buffer pump not running.
- CORRECTIVE ACTION: Enter PUMP diagnostics and verify buffer pump performance.
- SECTION: 7.5

- POSSIBLE CAUSE: Buffer pump not performing properly.
- CORRECTIVE ACTION: Replace tubing.
- SECTION: 8.6

- POSSIBLE CAUSE: Stir bar not present.
- CORRECTIVE ACTION: Disassemble chamber and reinstall stir bar.
- SECTION: 8.3

- POSSIBLE CAUSE: Stir bar not spinning.
- CORRECTIVE ACTION: Enter STIR diagnostics and check motor performance.
- SECTION: 7.4

- POSSIBLE CAUSE: Failing enzyme membrane.
- CORRECTIVE ACTION: Perform daily operational checks and replace if necessary.
- SECTION: 6.7

- POSSIBLE CAUSE: Newly installed enzyme membrane.
- CORRECTIVE ACTION: Enter PROBE diagnostics and check probe current.
- SECTION: 7.1

- POSSIBLE CAUSE: Newly installed enzyme probe.
- CORRECTIVE ACTION: Enter PROBE diagnostics and check probe current.
- SECTION: 7.1

- POSSIBLE CAUSE: Enzyme probe surface fouled.
- CORRECTIVE ACTION: Clean probe surface.
- SECTION: 8.5

- POSSIBLE CAUSE: Temperature probe (auxiliary electrode) surface fouled.
- CORRECTIVE ACTION: Clean probe surface.
- SECTION: 8.5

- POSSIBLE CAUSE: Main power disruption.
- CORRECTIVE ACTION: Enter PROBE diagnostics and check probe current.
- SECTION: 7.1

ERROR: MEMB SENS
PRESS MENU

This fault is generated only during the Calibration cycle. Because a sample of a known concentration (5 mmol/L Lactate Standard) has been injected, the current generated should fall within an expected range (5-45 nA). If the actual current is higher or lower than expected the above message will be displayed.

- POSSIBLE CAUSE: Improper sample injection.
- CORRECTIVE ACTION: Repeat procedure.
- SECTION: 4.1

- POSSIBLE CAUSE: Failing enzyme membrane.
- CORRECTIVE ACTION: Perform daily operational checks and replace if necessary.
- SECTION: 6.7

- POSSIBLE CAUSE: Pinched, plugged, leaking or disconnected tubing.
- CORRECTIVE ACTION: Fix or replace tubing.
- SECTION: 8.6

- POSSIBLE CAUSE: Calibrator solution out of spec: contaminated or in use for more than 30 days.
- CORRECTIVE ACTION: Replace Calibrator solution and repeat procedure.

- POSSIBLE CAUSE: Enzyme probe surface fouled.
- CORRECTIVE ACTION: Clean probe surface.
- SECTION: 8.5

- POSSIBLE CAUSE: Temperature probe (auxiliary electrode) surface fouled.
- CORRECTIVE ACTION: Clean probe surface.
- SECTION: 8.5

- POSSIBLE CAUSE: Stir bar not present.
- CORRECTIVE ACTION: Disassemble chamber and reinstall stir bar.
- SECTION: 8.3

- POSSIBLE CAUSE: Stir bar not spinning.
- CORRECTIVE ACTION: Enter STIR diagnostics and check motor performance.
- SECTION: 7.4

ERROR:OVER-RANGE
PRESS MENU

This fault is generated when the sample concentration exceeds the upper limit of the dynamic range (30 mmol). No result will be stored in memory.

- POSSIBLE CAUSE: Sample concentration is too high, resulting in high probe current.
- CORRECTIVE ACTION: Dilute sample 1:1 with the same buffer solution being used in the instrument and repeat.
- SECTION: 6

- POSSIBLE CAUSE: Excessive sample carryover on the outside of the Syringepet needle or capillary tube.
- CORRECTIVE ACTION: Repeat sampling procedure making sure to wipe excess sample from the outside of the injection device.
- SECTION: 6

Temperature Faults

ERR: BAD TEMP
PRESS MENU

The instrument will work only over the specified temperature range (5-45°C).

- POSSIBLE CAUSE: Ambient temperature too cold or hot.
- CORRECTIVE ACTION: Operate at ambient temperatures between 5 and 45°C.

TEMP UNSTABLE "PRESS MENU"

- POSSIBLE CAUSE: If this fault appears after a sample cycle and no result has been displayed the sample chamber temperature is changing too rapidly, (more than 3°C from the sample cycle to the reference cycle).
- CORRECTIVE ACTION: Allow the instrument supply fluids to equilibrate at the ambient temperature.
- CORRECTIVE ACTION: Place the SPORT out of direct sunlight and allow several minutes for stabilization.

TEMP CHANGE
FLUSHING...

This display will appear prior to any sample or calibrator injection if the sample chamber temperature has changed more than 1°C since the last wash cycle. A full wash cycle will be automatically initiated to insure that the contents of the chamber are not artificially warmed because of direct sunlight or other phenomena. Once the wash cycle is complete the chamber will be ready for injection.

Fluid System Faults

ERROR: REF CONCENTRATION LO

This warning is generated when the Reference solution concentration is calculated to be less than 80% of the injected Calibration standard (YSI 2327 5 mmol/L Lactate Std.). It is possible that significantly high or low Reference solution concentrations can have a negative effect on the performance of the SPORT at the upper most part of the dynamic range. If this fault is encountered during an attempt to calibrate the instrument, replace the Reference solution and repeat the calibration process.

ERROR: REF CONCENTRATION HI

This warning is generated when the Reference solution concentration is calculated to be greater than 120% of the injected Calibration standard (YSI 2327 5 mmol/L Lactate Std.). It is possible that significantly high or low Reference solution concentrations can have a negative effect on the performance of the SPORT at the upper most part of the dynamic range. If this fault is encountered during an attempt to calibrate the instrument, replace the Reference solution and repeat the calibration process.

UNSTABLE REFCUR PRESS MENU

This fault can be generated in two different scenarios. One during the calibration process, the second during a sampling cycle.

If it occurs during **calibration** it is because the measured reference current after the calibrator injection is different from the measured reference current after the linearity injection by more than 5%.

If it occurs during **sampling** it is because the measured reference current after the sample injection is different from the measured reference current after the original calibration injection by more than 20%.

- POSSIBLE CAUSE: Probe and membrane not stabilized as a result of recent power up or power interruption.
- CORRECTIVE ACTION: Enter PROBE Diagnostics and check to see if current is stable or falling. Allow to stabilize then re-calibrate.
- SECTION: 7.1

- POSSIBLE CAUSE: Supply tubing crimped prohibiting reference solution flow to the chamber.
- CORRECTIVE ACTION: Visually inspect all pump tubing.

9.2 Possible Failure Conditions

The following are possible failures that may go undetected unless confirmed visually but can affect instrument performance.

Air bubble in the sample chamber

- POSSIBLE CAUSE: Loose fittings on supply bottles.
- CORRECTIVE ACTION: Tighten fittings.

- POSSIBLE CAUSE: Supply line check valves stuck open.
- CORRECTIVE ACTION: Flush or replace check valves.
- POSSIBLE CAUSE: Tubing worn or stretched at connections.
- CORRECTIVE ACTION: Replace tubing.
- SECTION: 8.6

- POSSIBLE CAUSE: Air bubble stuck to stir bar.
- CORRECTIVE ACTION: Go to stir bar setup and increase speed until the stir bar tumbles (** See below). Reset spin speed.
- SECTION: 3.6

** The stir bar is driven by a spinning magnetic coupling, if the speed is increased the coupling will be interrupted and the stir bar will tumble and vibrate fairly violently. If bubble will still not release, take a small diameter pin or other device (paper clip works well) and stick it into the sample chamber through the injection port and interrupt the stir bar motion. The bubble should release itself at this point.

- POSSIBLE CAUSE: Buffer and/or Reference tubing line in pumps crimped shut.
- CORRECTIVE ACTION: Disassemble pumps and open tubing or replace if more than 6 months since last replaced.
- SECTION: 8.6

Buffer and/or Reference pump fail to pump fluid.

- POSSIBLE CAUSE: Tubing line in pumps crimped or stuck shut.
- CORRECTIVE ACTION: Disassemble pumps and open tubing or replace if more than 6 months since last replaced.
- SECTION: 8.6

- POSSIBLE CAUSE: Supply line blocked.
- CORRECTIVE ACTION: Clear tubing or replace.
- SECTION: 8.6

- POSSIBLE CAUSE: Supply line check valve stuck open.
- CORRECTIVE ACTION: Flush check valve or replace.

- POSSIBLE CAUSE: Bottle vent plugged, causing negative pressure in the supply bottle.
- CORRECTIVE ACTION: Loosen supply bottle cap to verify, clear blockage or replace vent.

- POSSIBLE CAUSE: Sample chamber inlet blocked.
- CORRECTIVE ACTION: Disassemble chamber, check for blockage in inlet port (lower).
- SECTION: 8.3

Sample chamber overflows through the injection port.

- POSSIBLE CAUSE: Waste tubing line in pumps crimped or stuck shut.
- CORRECTIVE ACTION: Disassemble pumps and open tubing or replace if more than 6 months since last replaced.
- SECTION: 8.6

- POSSIBLE CAUSE: Waste line blocked.
- CORRECTIVE ACTION: Clear tubing or replace.
- SECTION: 8.6

- POSSIBLE CAUSE: Waste line check valve stuck open.
- CORRECTIVE ACTION: Flush check valve or replace.

- POSSIBLE CAUSE: Bottle vent plugged, causing positive pressure in the waste bottle.
- CORRECTIVE ACTION: Loosen waste bottle cap to verify, clear blockage or replace vent.

- POSSIBLE CAUSE: Capillary tube plug broken loose from tube and stuck in waste chamber port.
- CORRECTIVE ACTION: Disassemble chamber, check for blockage in outlet port (upper).
- SECTION: 8.3

- POSSIBLE CAUSE: Sample chamber outlet blocked.
- CORRECTIVE ACTION: Disassemble chamber, check for blockage in outlet tube due to salt buildup, and clean if necessary.
- SECTION: 8.3

Stir bar fails to spin.

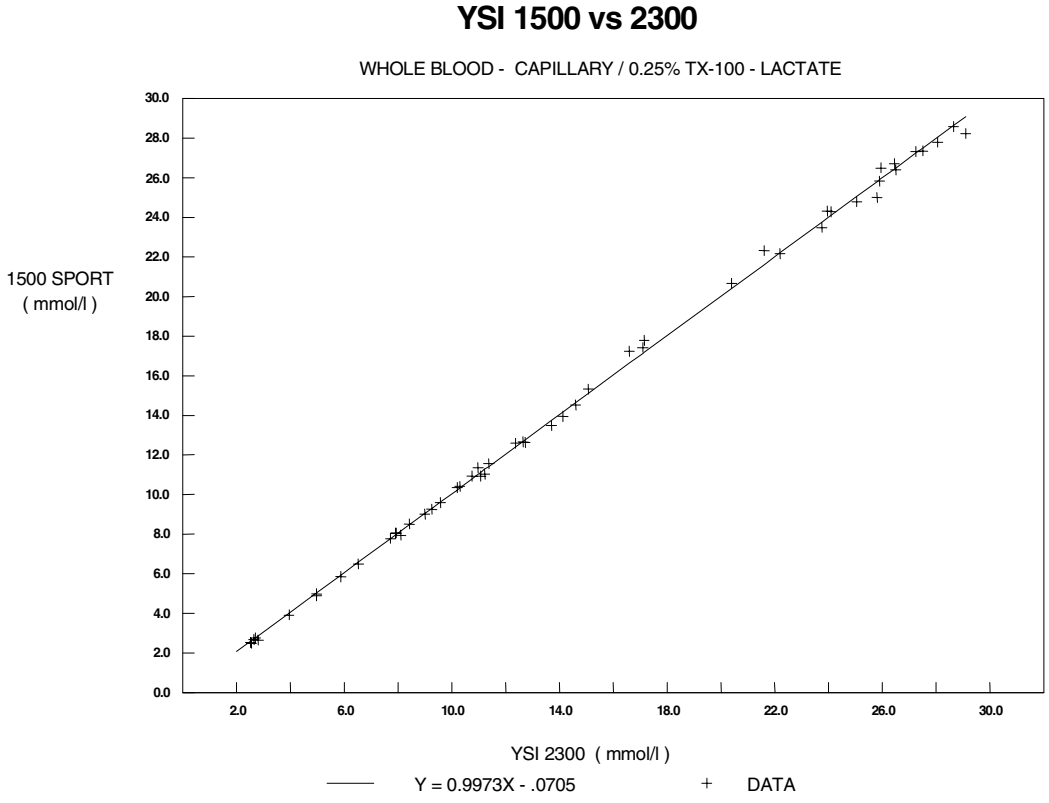
- POSSIBLE CAUSE: Stir bar stuck to chamber.
- CORRECTIVE ACTION: Clean the sample chamber.
- SECTION: 8.3

- POSSIBLE CAUSE: Stir motor failure.
- CORRECTIVE ACTION: Go to stir motor diagnostics and verify.
- SECTION: 7.4

10. Appendix A–Typical Performance Data

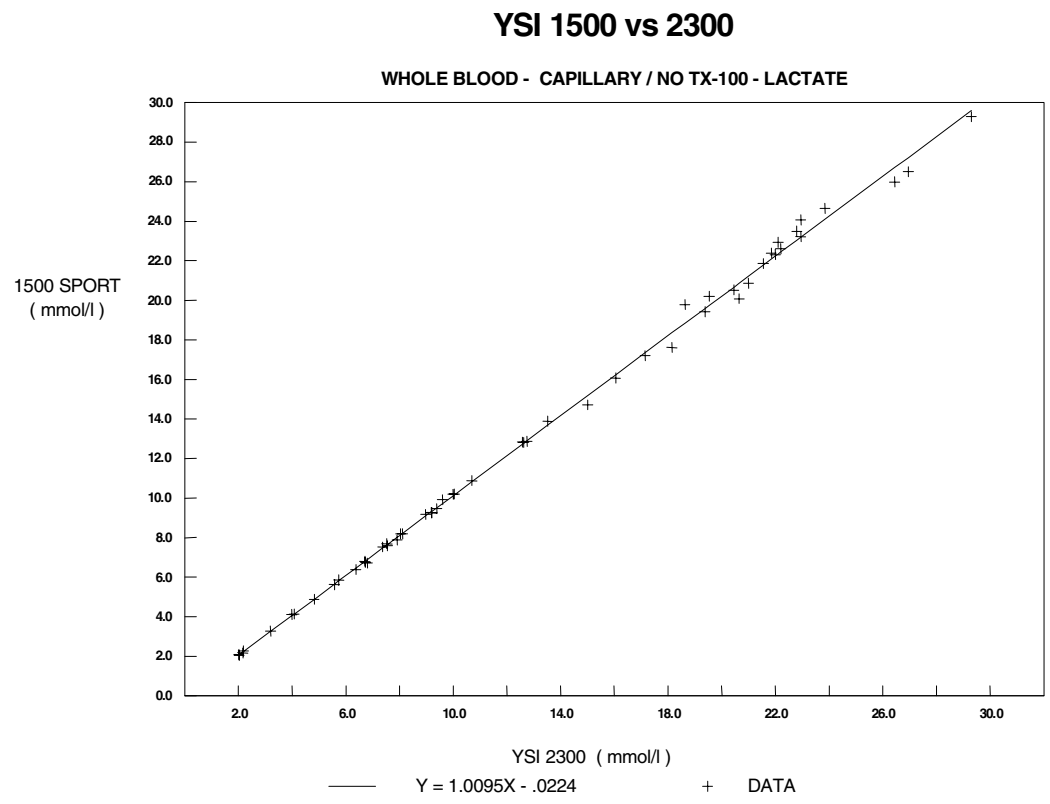
Testing of the YSI Model 1500 SPORT vs. the YSI Model 2300 STAT suggests the following typical performance:

Capillary Tube Injector, YSI Model 1502



Total Blood Lactate - YSI 1515 cell lysing agent added to the buffer solution in both instruments.

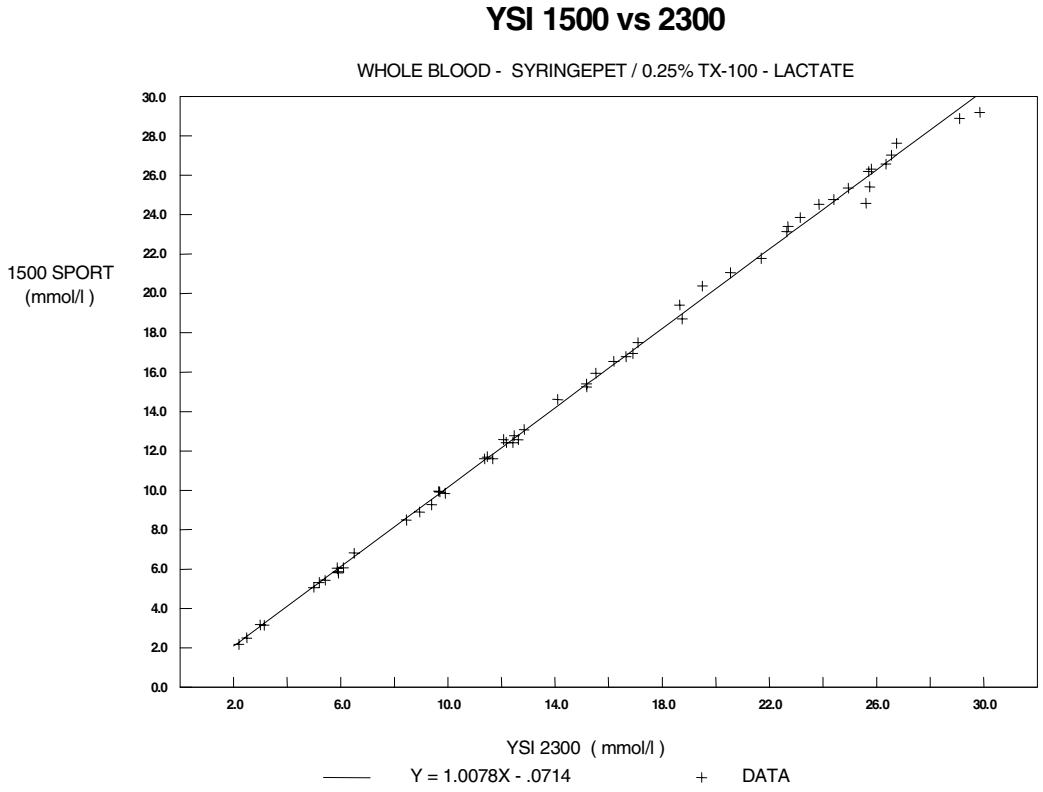
Concentration	Pooled Est. Std. Dev.	Mean Bias
0-10 mmol/L	0.1 mmol/L	0.0 mmol/L
10-20	0.2	0.1
20-30	0.4	0.0



Whole Blood Lactate - Extracellular ONLY

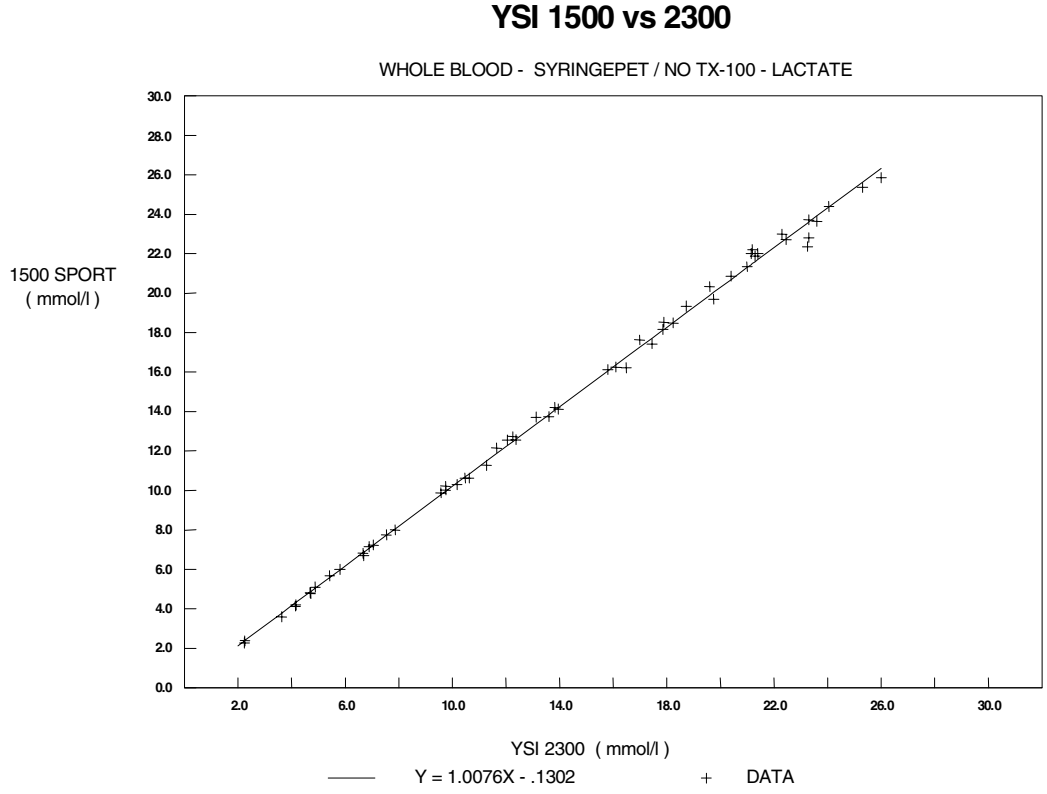
Concentration	Pooled Est. Std. Dev.	Mean Bias
0-10 mmol/L	0.1 mmol/L	0.1 mmol/L
10-20	0.3	0.2
20-30	0.4	0.3

Blunt Needle Syringepet, YSI Model 1501



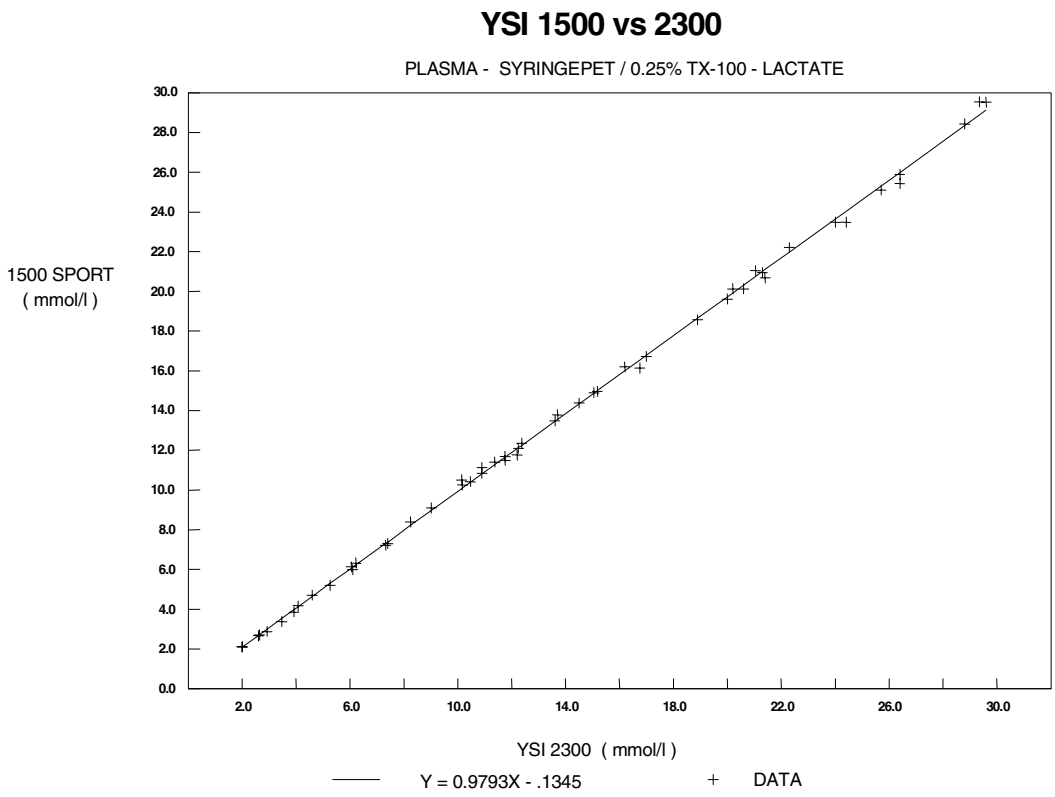
Total Blood Lactate - YSI 1515 cell lysing agent added to the buffer solution in both instruments.

Concentration	Pooled Est. Std. Dev.	Mean Bias
0-10 mmol/L	0.1 mmol/L	0.1 mmol/L
10-20	0.3	0.3
20-30	0.5	0.2



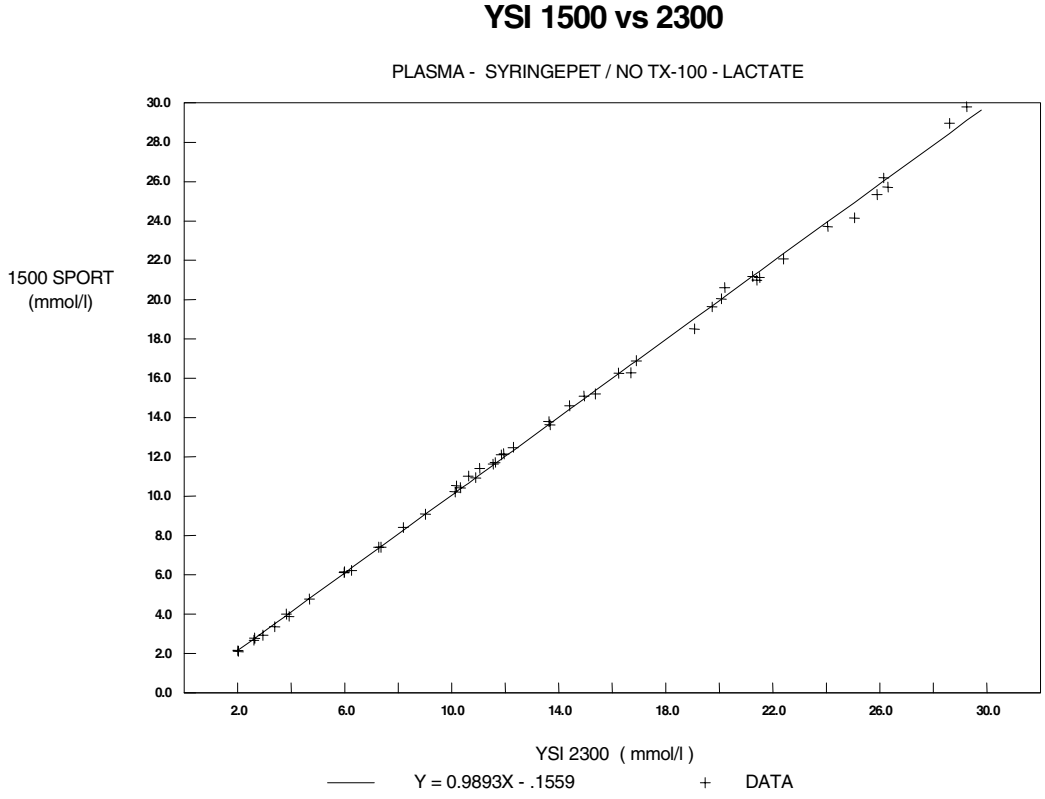
Whole Blood Lactate - Extracellular ONLY

Concentration	Pooled Est. Std. Dev.	Mean Bias
0-10 mmol/L	0.1 mmol/L	0.1 mmol/L
10-20	0.3	0.2
20-30	0.4	0.3



Plasma Lactate - YSI 1515 cell lysing agent added to the buffer solution in both instruments.

Concentration	Pooled Est. Std. Dev.	Mean Bias
0-10 mmol/L	0.0 mmol/L	0.0 mmol/L
10-20	0.1	0.1
20-30	0.4	0.4



Plasma Lactate - Without YSI 1515 cell lysing agent added to the buffer solution of either instrument.

Concentration	Pooled Est. Std. Dev.	Mean Bias
0-10 mmol/L	0.1 mmol/L	0.1 mmol/L
10-20	0.2	0.1
20-30	0.3	0.1

11. Appendix B–Sample Collection and Handling

The YSI 1500 SPORT is not intended for home use. Proper sample collection and preparation, by a professional, are vital factors in obtaining reliable results with the YSI SPORT. This section covers the basic guidelines for collecting and preparing whole blood, plasma and serum samples.

Much of the Blood Plasma and Blood Serum material is abstracted from "Workshop Manual of Methods for the Determination of Glucose" by Gerald R. Cooper, M.D., Ph.D. published by the Commission on Continuing Education, Council on Clinical Chemistry, American Society of Clinical Pathologists (1966).

Blood Plasma

Be sure that all collection equipment is sterile and chemically clean. Use aseptic techniques in handling the sample from collection through assay.

During or immediately after collection, mix the specimen with an anticoagulant and preservative to prevent coagulation, inhibit enzyme activity and prevent bacterial growth. Separate the red blood cells by centrifugation within 30 minutes of collection. If delays between collection and assay are unavoidable, follow one of these procedures:

1. Refrigerate the whole blood at +4°C. This is acceptable for periods up to four hours.

2. Or, refrigerate the plasma with preservatives at +4°C for up to three days. Plasma with preservative left at room temperature may keep up to four hours.

3. Or, freeze the cell-free plasma with preservative at -10°C or colder. Plasma will keep indefinitely at this temperature. Thaw the frozen plasma rapidly at 25°C and analyze promptly. The freeze-thaw cycle should not be repeated. Tubes containing cells should never be frozen.

NOTE: Chilling or freezing may precipitate aggluten or fibrinogen masses which may not redissolve. In such cases, remove them by centrifugation before assay.

Several common anticoagulants are suitable for use with specimens being prepared for assay. These include:

Potassium oxalate in a concentration of 2 mg/ml of blood.

Sodium fluoride in a concentration of 5-10 mg/ml of blood.

EDTA in a concentration of 1 mg/ml of blood.

Sodium fluoride and oxalate in combination in a total concentration of 2 mg/ml of blood.

Heparin sodium as commonly supplied in Vacutainer collection tubes.

⚠ WARNING: The YSI SPORT is not suitable for use with samples containing thymol or other phenol preservatives. These are interfering substances.

Oxalate anticoagulants, and particularly the combination of sodium fluoride and oxalate, may produce hemolysis, which can cause disagreement between results from the SPORT and some reference methods.

⚠ Warning: Frozen blood-bank blood, which contains a high percentage of glycerine, is not a suitable specimen for diagnostic work with the SPORT.

Blood Serum

Draw blood for serum preparation into a dry tube without additives. Silicone-coated tubes and stoppers lubricated with glycerine or silicone are acceptable.

After the specimen stands 15 minutes at room temperature, loosen the clot from the wall of the tube with a sterile glass rod or applicator. Add sterile beads, if desired. Centrifuge the specimen promptly to separate the serum from the clot.

If delays are unavoidable follow one these procedures:

1. Refrigerate the whole blood at +4°C. This is acceptable for periods of up to 4 hours.

2. Or, prolonged storage, isolate the serum from the clot within 30 minutes of collection and freeze it at -10°C or colder. Serum will keep indefinitely at this temperature. Thaw the frozen serum rapidly at 25°C and analyze promptly. The freeze-thaw cycle should not be repeated. Tubes containing cells should never be frozen.

   NOTE: Freezing may precipitate aggluten or fibrinogen masses which may not redissolve. You can remove these by centrifugation before assay.

3. Or by adding a chemical preservative. Preservatives are not commonly used with serum; however, sodium fluoride in concentrations of 7.5 mg/ml of blood, EDTA in concentrations of 1 mg/ml of blood, or boric acid in concentrations of 8 mg/ml of blood will substantially halt glycolysis in most, but not all, specimens. If sodium iodoacetate is used as an antiglycolytic, it must be free of iodide and iodine.

⚠ WARNING: The YSI Model 1500 is not suitable for use with samples containing thymol or other phenol preservatives. These are interfering substances.

⚠ Warning: Frozen blood-bank blood, which contains a high percentage of glycerine, is not a suitable specimen for diagnostic work with the Model 1500.

Whole Blood

If more than five minutes will elapse between the time you draw a specimen and analyze it, you should mix the blood with an anticoagulant during or immediately after collection. Analysis of whole blood without an anticoagulant is not recommended. The preferred anticoagulants are EDTA in a concentration of 1 mg/ml of blood, or heparin sodium as commonly supplied in Vacutainer collection tubes.

Other effective anticoagulants which may be used are potassium oxalate in a concentration of 2 mg/ml of blood, sodium fluoride in a concentration of 5-10 mg/ml of blood, or sodium fluoride and EDTA in a concentration of 2.5mg fluoride and 1 mg EDTA per ml of blood. These are not know to cause any error in the measurement of whole blood lactate, but they may cause a reduction of the sample's hematocrit value with or without accompanying hemolysis. This would lead to a slight error in the calculated plasma lactate value. Hemolysis can cause disagreement between readings on the Model 1500 and some reference methods.

Cell metabolism will result in increased lactate concentrations in the specimen through glycolysis, which will result in erroneously high assay values. Glycolysis is particularly rapid in whole blood specimens, and these should be analyzed within an hour of drawing. Refrigeration at +4°C will retard glycolysis and extend the acceptable delay to four hours. Whole blood specimens must not be frozen. Some authorities recommend the use of chemical preservatives to minimize glycolysis:

Fluoride in concentrations of 7.5 mg/ml of blood.

Boric acid in concentrations of 8 mg/ml of blood.

Sodium iodoacetate; if sodium iodoacetate is used as the antiglycolytic, it must be free of iodide and iodine.

YSI has not evaluated the effects of these antiglycolytics.

⚠ WARNING: The YSI SPORT is not suitable for use with samples containing thymol or other phenol preservatives. These are interfering substances.

Before taking a sample from a whole blood specimen, any cells which may have settled out must be resuspended. Invert the collection tube three times, gently enough not to cause frothing, just before sampling. Samples which have settled for more than an hour (particularly if they have been refrigerated) should be placed on a blood rotator for five minutes to break up clumps of cells.

Air bubbles or froth in the sample drawn into the sipper can lead to significant errors in the form of low lactate readings. Because it is difficult to detect bubbles visually in whole blood specimens, you should exercise great care. Any unexpectedly low lactate readings may indicate a bubble; if possible, repeat the determination.

⚠ Warning: Frozen blood-bank blood, which contains a high percentage of glycerine, is not a suitable specimen for diagnostic work with the SPORT.

12. Appendix C–Cell Lysing

Obtaining reliable results that have value requires a basic understanding of what is going on inside the whole blood sample, at least as it relates to lactate.

Lactate is always present in the blood plasma at some level due to minor anaerobic activity. As the consumption of free oxygen increases during exercise, anaerobic activity increases, and so does the lactate concentration.

Lactate production starts inside the muscle cell, and the lactate then diffuses through the cell wall into the blood cell carrier fluid, plasma. The plasma lactate will then in turn diffuse through the red blood cell walls in order to achieve an equilibrated state. It takes several minutes for this to happen. As a result, depending at which point in an exercise the whole blood sample is taken, the concentration of plasma lactate (extracellular), may be significantly different than the concentration of lactate in the red blood cell (intracellular).

For example if the sampling was done very early, the equilibration of the plasma lactate and the cell lactate will not have taken place yet and the plasma lactate concentration will be higher. Conversely, if the sampling was done much later, the lactate concentrations will be much closer or equal.

In a **non-lysing system** the blood cell walls create a barrier that the intracellular lactate can "hide behind". When a blood sample is injected into the sample chamber, the extracellular lactate dilutes into the buffer solution immediately. The intracellular lactate does not however due to the time required to diffuse through the cell walls. Given sufficient time the lactate would diffuse through the cell walls and then dilute into the buffer solution allowing all of the the lactate to be measured. This is not practical however as the rate at which this diffusion would take place would severely lengthen the duration of each measurement cycle. **Therefore the only lactate that can be measured on a SPORT in a non-lysing system is extracellular.**

What this means quite simply is that without a way of assuring that the cell walls have been removed when we do a sample measurement, we can never expect to get a true **TOTAL LACTATE** reading on the SPORT

This can be done by introducing certain chemicals into the buffer solution inside the sample chamber that effectively tear apart the cell walls of the blood sample immediately upon contact. This allows both the intracellular and extracelleular lactate to dilute immediately into the buffer solution, and because preservatives now can access the contents of the cell, any additional lactate production is prevented within the sample.

Another variable that plays a significant role in the lactate equation is how the sample is cared for prior to measurement. If the sample is exposed to elevated temperatures before measurement it is quite likely that additional lactate production will continue within the unlysed blood cells. This can add to the

inaccuracy of determining an athletes actual lactate level, which can affect the appraisal of the athletes performance.

IMPORTANT: YSI strongly recommends that you use the YSI 1515 Cell Lysing Agent. Without total cell lysis (breaking apart of cell walls), results obtained on whole blood can vary significantly depending on individual hematocrit levels, on whether unintended partial cell lysis takes place, on temperature changes, and the amount of time that elapses from the time of sample collection until the analysis is completed.

The presence of the lysing agent in the buffer solutions eliminates these problems, and also allows the results to be compared directly to more traditional total blood lactate laboratory techniques.

Using the YSI 1515 Cell Lysing Agent

If your sample measuring protocol requires the total lysis of blood cells, or if you are going to preserve the samples with the YSI 2315 Preservative Tube Kit for later analysis, another step is required in the reagent preparation process explained in Section 3.3 Reagent Preparation.

Buffer Solution

Fill the 500mL mixing bottle with reagent water. Reagent water must be very pure. Use high quality deionized water or distilled water. Add one package of YSI 2357 Buffer Concentrate and stir, waiting long enough to be certain that the buffer chemicals have completely dissolved.

Add one packet of YSI 1515 Cell Lysing Agent and stir.

Pour the solution into the instrument Buffer Bottle.

Reference Solution

Fill the 500mL mixing bottle with reagent water. Reagent water must be very pure. Use high quality deionized water or distilled water. Add one package of YSI 2357 Buffer Concentrate and stir, waiting long enough to be certain that the buffer chemicals have completely dissolved.

Add 4.5 mL of YSI 1530 30 mmol/L Calibration Standard, and stir as necessary. This should be measured out with the graduated syringe supplied in the 1504 Starter Kit. Replace the bottle lid and shake the bottle for 15 seconds to insure complete mixing**. It is important for reliable results that the reference solution is completely mixed.**

Add one packet of YSI 1515 Cell Lysing Agent and stir.

Pour this solution into the Reference Bottle.

WARNING: If you switch from running with, to running without the lysing agent, or vice versa, you cannot get reliable results unless you allow sufficient time for complete removal of the agent from the fluid system.

13. Appendix D Sample Preservation

It is possible to collect samples for later analysis if the situation dictates it. For this application the **YSI 2315 Preservative Tube Kit** is available. The kit consists of re-sealable tubes containing a preservative powder and packets of YSI 1515 Cell Lysing Agent.

> ⚠ **WARNING: You must use the YSI Cell Lysing Agent in your SPORT when running samples preserved in YSI preservative tubes.**

You cannot use the YSI preservative tubes unless the lysing agent is used in the instrument when the actual measurement takes place. This is due to the fact that the preservative tubes contain a detergent. This detergent, when introduced into a system without the cell lysing agent, can affect the membrane response and cause incorrect readings. While this detergent is also present in the cell lysing agent, the response effect is compensated for during normal calibration, and the sudden introduction of a sample containing the detergent will have no adverse effect. Refer to Appendix E–Effects Of Selected Substances.

A sample size of 100 microliters minimum is required for each tube.

Samples preserved in YSI preservative tubes can be stored for up to 48 hours @ 25°C, and for up to 7 days @ 5°C.

14. Appendix E–Effects Of Selected Substances

Paracetamol (Tylenol, Acetaminophen) can be a significant interference in overdose situations.Effective therapeutic levels of Paracetamol in blood (0.07 - 0.14 mmol/L) are not a problem. The pharmacokinetic literature suggests that one would have to injest more than 3 times the recommended therapeutic dose in order for the plasma levels to be greater than 0.17mmol/L.

Paracetamol interferees with the SPORT measurement because it can penetrate the cellulose acetate portion of the enzyme membrane and is oxidizable at the platinum eletrode at the applied polarization voltage. The presence of elevated levels of Paracetamol in a sample results not only in an elevated lactate reading, but also a ramping signal in the time region in which a steady state signal is normally observed.

⚠ Warning: The following preservatives interfere with the measurement and should not be used: Phenol, Benzalkonium Chloride, Methyl Paraben, Per chloric Acid, Sodium Azide, Thymol, Trichloracetic Acid.

Several classes of chemicals can damage the YSI sensor system or cause erroneous readings. Most of these have no place in diagnostic medicines, but may be of scientific interest. Some substances such as triglycerides, which are interferences for photometric sensor systems, do not interfere with the SPORT electrochemical sensor system.

Reducing Agents

Many reducing agents would give rise to a false signal current (and falsely elevated reading) if they succeeded in reaching the sensing anode of the YSI probe. Most of these are excluded from the probe by the cellulose acetate layers of the membrane, However, thymol, phenols, anilines, hydra zines and hydrazides, hydroxylamines, oximes and a few other compounds of molecular weight below 150 which are cationic or uncharged in neutral solution can interfere.

Homologues and isomers may be expected to behave similarly, except that relative response generally declines with increasing molecular (or ionic) bulkiness. Hydrogen Sulfide, Hydrazine, Methylhydrazine, Phenylhydrazine, Oxamic Hydrazide, Hydroxyet hylhydrazine, Acetone Oxime, Hydroxylamine and Sodium Borohydride are also known to give significant relative response. Relative response to reducing agents may vary from membrane lot to membrane lot, and may depend on the service history of the probe and membrane.

The following reducing agents may result in an elevated background current when present at low levels (only a few milligrams per liter):

Aniline
Phenol
Thiocarboyhdrazide
Thiourea
Resorcinol
Guaiacol
2-Mercaptoethanol
Ethyl Carbazate
Formic Acid Hydrazide
Catechol
Acetaminophen

The following materials may cause trouble at higher concentrations:

2-Amino-4-nitrophenol
Hydroquinone
p-Cresol
p-Phenylenediame
Isoniazid
o-Toluidine
Methimazole
2-Hydroxybenzyl Alcohol
4-Ethylphenol
p-Aminophenol
Pyrogallol
Oxalyl Dihydrazide
N.N-Dimethylhydroxylamine
Sodium Azide

Calibration Shift by Detergents

The sensitivity of the platinum anode of the sensor is affected somewhat by absorption or desorption of material from the buffer which bathes it. In normal operation, such changes are quite gradual and are corrected in the periodic recalibration of the instrument. However, concentrated detergent solutions may have a much more sudden effect. Concentrated anionic detergents can cause readings to be abruptly elevated or depressed; concentrated nonionic detergents generally depress readings. For this reason, concentrated detergent solutions should not be sampled. No problem has been observed from the naturally occurring detergency of specimens.

Endogenous and Exogenous Substances

YSI has tested hundreds of substances to determine whether they have any effect on the sensor system used in the SPORT. YSI has also verified that the addition of Triton X-100 to the SPORT instrument buffer does not significantly alter the extent to which these materials interfere with the instrument.

The endogenous substances listed were all tested at levels far higher than can be found in the body, and all were found to be noninterfering at the highest naturally occurring levels. The column headed "Interfering Level" indicates the concentration at which each substance might be expected to cause an error of 1 mmol/l in the lactate reading. Certain exogenous substances can interfere with measurements, and nothing should be added to the specimens except those anticoagulants and antiglycolytics recommended in Appendix B–Sample Collection and Handling.

Recent information indicates that some of the exogenous substances listed are now drugs that are abused, that is, ingested at levels much higher than the usually recommended therapeutic doses. In patients with higher than therapeutic levels, there is hazard of gross masking of lactate concentration by the interfering substance. The SPORT should not be used to analyze specimens containing any of these substances at or above the listed Interfering Level.

Physical Damage

Never inject concentrated mineral acids, concentrated bases, or strong organic solvents into the YSI SPORT as these may permanently damage the enzyme membranes or the plastic parts of the probe and sample chamber. Do not inject water-insoluble oils or greases, because it may be difficult to clear them from the sample chamber. Blood specimens with excessive content of fats are not a problem.

Substance	Weight	Lactate Interfering Level	
		mg/dL	mmol/L
Anticoagulants:			
Sodium Oxalate	134.00	-- --	
Heparin Sodium	--	-- --	
Dipotassium EDTA	404.46	-- --	
Sodium Citrate	294.10	-- --	
Preservatives:			
Sodium Flouride	42.00	-- --	
Iodoacetic Acid	185.96	24,346	1309
2-Iodoacetamide	185.95	3,356	180
Sodium Tetraborate 10 H2O	381.37	54,000	1416
Benzalkonium Chloride	396.11	1,200	30
Cetylpyridinium Chloride	357.99	-- --	
Sodium Azide	65.01	588	90
Methylparaben	152.15	168	11
Phenol	94.11	6.7	0.71
Thymol	150.22	600	40

Substance	Weight	Lactate Interfering Level	
		mg/dL	mmol/L
Lactic Acid Analogues			
DL-a-Glycerophosphate,Disodium	216.4	-- --	
DL-Glyceric Acid, hemi-calcium	286.25	1276	9.6
Glycolic Acid	76.05	177	23
B-Hydroxypyruvic Acid,Lithium salt	110	-- --	
DL-B-Hydroxybutyric Acid,Sodium salt	126	-- --	
4-Hydroxybutyric Acid,Sodium salt	126.09	-- --	
DL-Malic Acid	134.09	-- --	
DL-a-Hydroxybutyric Acid	126.09	84	6.7
L-B-Phenyllactic Acid	166.18	24	1.4
B-Chlorolactic Acid	124.52	93	2.4
Oxalacetic Acid	132.07	-- --	
Glycine	75.07	-- --	
DL-Alanine	89.09	-- --	
B-Alanine	89.09	-- --	
DL-a-Hydroxycaproic Acid	132.16	45	3.4
Pyruvic Acid,Sodium Salt	110.04	-- --	
DL-a-Hydroxyisovaleric Acid	118.13	-- --	
L-a-Hydroxyisocaprioc Acid	132.16	75	5.7
a-Hydroxyisobutyric Acid	104.11	-- --	
Glycerol	92.09	-- --	

Substance	Weight	Lactate Interfering Level	
		mg/dL	mmol/L
Drugs, Poisons, and Miscellaneous Exogenous Substances:			
Acetaminophen	151.17	15	1.0
Metaphosphoric Acid	--	-- --	
Ethanol	46.07	-- --	
Methanol	32.04	-- --	
Iso-Propanol	60.10	-- --	
Ethylene Glycol	62.07	-- --	
Acetylsalicylic Acid	180.16	-- --	
Formaldehyde	30.03	2606	868
Hydrogen Peroxide	34.02	1.1	0.32
D-Penicillamine	149.21	4376	293
Salicylamide	137.14	12	0.88
Sodium Nitrite	69.00	108	15
Sodium Salicylate	160.11	-- --	
Ascorbic Acid	176.12	1800	102
D-Galactose	180.16	-- --	
D-Glucose	180.16	-- --	
D(+)Glucosamine HC1	215.64	-- --	
Glucose-6-phosphate, Monosodium	282.12	-- --	
Uric Acid	168.11	-- --	
p-Aminosalicylic Acid	153.14	8.0	0.52
2,3-Dimercapto-propanol	124.22	-- --	
Guaiacol	124.14	3.1	0.25
Hydrazine Sulfate	130.12	13	1.0
Hydroquinone	110.11	4.3	0.39
Hydroxylamine Hydrochloride	69.49	1.6	0.23
Isoniazid	137.14	12	0.88
2-Mercaptoethanol	78.13	1.0	0.13
p-Phenylenediamine HC1	181.07	2.9	0.165
Potassium Cyanide	65.12	-- --	
Potassium Iodide	166.01	209	12
Potassium Thiocyanate	97.18	107	11
Pyridoxine Hydro-chloride	205.64	192	9.3
Sodium Sulfide Nonhydrate	240.18	0.9	0.04
2-Thiouracil	128.15	-- --	
Thiourea	76.12	3.2	0.42
o-Tolidine Dihydro-chloride	285.22	-- --	
o-Toluidine	107.16	3.60	.34

15. Appendix F–Temperature Effect on Operation

Both the measurement chemistry and the electrical performance have very predictable reactions to changes in ambient temperatures. To correct for these changes, a temperature compensation algorithm has been included in the result calculation; however, to guarantee accurate results we compensate only over a limited range. It may be possible that in some situations the 1500 SPORT may appear to be overly sensitive to "TEMPERATURE STABILITY ERRORS". If that is the case, there are simple precautions that should be taken to insure the quality of the results.

Whenever possible, the 1500 SPORT and the fluid supplies should be equilibrated to the ambient temperature of the actual testing site and then calibrated. This is quite easily done when testing indoors but requires special effort if done outdoors.

When testing outdoors the 1500 SPORT should be kept out of direct sunlight. Direct sunlight can cause rapid warming of the sample chamber, warming the contents much faster than the larger fluid supply bottles. If this happens it is quite possible that the 1500 SPORT will detect "TEMPERATURE STABILITY ERRORS". Simply keeping the unit in the shade regardless of ambient temperature will assure that the warming or cooling effects are consistent, and therefore the results accurate.

Temperature Effect On Battery Life

The length of available sampling time is affected by the ambient temperature while testing. The colder the temperature, the more battery life is affected. Typically the results of our testing indicate the following estimated guidelines:

Ambient Temperature	Sampling Duration	Samples Ran
45°C	8 Hours	90
25°C	8 Hours	90
5°C	7 Hours	75

IMPORTANT:

1. All testing done on units that were precharged for 8 hours using YSI Model 1550 wall mounted chargers.

2. These tests were conducted running samples continuously (1 every 2 minutes). It is quite clear that if fewer samples are being run, the actual sampling duration will increase.

3. Sampling duration is defined as starting point to software lockout. Refer to Section 5.8 Software Structure, Battery Level Checks for more information relating to battery voltage monitoring.

16. Appendix G–Accessory Products

The following products are available from YSI or your sales representative.

YSI Catalog Number	Description	
1501	25 microliter, Blunt Needle Syringepet	
1502	25 microliter, Capillary Tube Injection Device	
1503	1500 Preventative Maintenance Kit	
1504	1500 L-Lactate Starter Kit	**Qty.**
	2327 Lactate Standard, 5 mmol/L	1
	1530 Lactate Standard, 30 mmol/L	1
	2329 Lactate Membranes	1
	2363 Potassium Ferrocyanide	1
	2392 NaCl Solution	1
	2357 Buffer Concentrate Kit	1
	1505 Capillary Tubes	1
	1515 Cell Lysing Agent	1
	Syringe, 3cc	1
1505	25 microliter, Capillary Tube Package, (100 count)	
1506	Hewlet Packard Infrared Printer (HP 82240)	
1515	Cell Lysing Agent, (8 packs)	
1530	Lactate Standard, 30 mmol/L, (125mL)	
015117	120 VAC 60 Hz Battery Charger	
015118	220 VAC 50 Hz Battery Charger	
2315	Preservative Tube Kit	**Qty.**
	1515 Cell Lysing Agent	1
	Preservative Tube	50
2327	Lactate Standard, 5 mmol/L, (125mL)	
2328	Lactate Standard, 15 mmol/L, (125mL)	
2329	Lactate Membranes, (4 count)	
2357	Buffer Concentrate Kit, (8 packs)	
2363	Potassium Ferrocyanide, (125mL)	
2392	NaCl Solution, (30mL)	
2751	Printer Paper, (5 rolls/box)	

17. Appendix H–Cleaning, Disinfecting and Decontamination

 Proper precautionary lab practices should be followed when handling biological hazards.

Suggested cleaning and disinfecting solutions:

- Isopropanol 70%
- Sodium hypochlorite, 5000 ppm free available chlorine, (1:10 solution of house hold bleach).

Disassemble parts that require cleaning, per instructions in Section 8 Maintenance. Thoroughly clean with the disinfecting agent. Rinse with warm water.

 **WARNING:** Clean probes with isopropanol only and rinse with warm water.

Clean up all spills then reassemble.

18. Appendix I–Warranty and Shipping Information

The YSI Model 1500 SPORT Analyzer is warranted for one year from date of purchase by the end user against defects in materials and workmanship, exclusive of batteries. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, write or call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

Limitation of Warranty

This Warranty does not apply to any YSI product damage or failure caused by (i) failure to install, operate or use the product in accordance with YSI's written instructions, (ii) abuse or misuse of the product, (iii) failure to maintain the product in accordance with YSI's written instructions or standard industry procedure, (iv) any improper repairs to the product, (v) use by you of defective or improper components or parts in servicing or repairing the product, or (vi) modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI's LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

YSI Factory Service Centers

United States

YSI Incorporated • Repair Center • 1725 Brannum Lane • Yellow Springs, OH • 45387 • USA
Phone: 937 767-7241 • Fax: 937 767-9353

Europe

Analytical Technologies • Lynchford House • Lynchford Lane • Farnborough, Hampshire • GU14 GLT • England
Phone: 441 252 514711 • Fax: 441 252 511855

YSI Authorized Service Centers

California

Fisher Scientific ISD • 2822 Walnut Avenue, Suite E • Tustin, CA • 92681 • Phone: 800 395-5442

Georgia

Fisher Scientific ISD • 2775 Horizon Ridge Court • Suwanee, GA • 30174 • Phone: 800 395-5442

Illinois

Fisher • 1600 West Gleenlake Avenue • Itasca, Ill • 60143 • Phone: 800 395-5442

New Jersey

Fisher Scientific ISD • 52 Fadem Road • Springfield, NJ • 07081 • Phone: 800 395-5442

Pennsylvania

Fisher Scientific ISD • 585 Alpa Drive • Pittsburgh, PA • 15238 • Phone: 800 395-5442

Cleaning Instructions

IMPORTANT: Before they can be serviced, equipment exposed to biological, radioactive, or toxic materials must be cleaned and disinfected. Biological contamination is presumed for any instrument, probe, or other device that has been used with body fluids or tissues, or with wastewater. Radioactive contamination is presumed for any instrument, probe or other device that has been used near any radioactive source.

If an instrument, probe, or other part is returned or presented for service without a Cleaning Certificate, and if in our opinion it represents a potential biological or radioactive hazard, our service personnel reserve the right to withhold service until appropriate cleaning, decontamination, and certification has been completed. We will contact the sender for instructions as to the disposition of the equipment. Disposition costs will be the responsibility of the sender.

When service is required, either at the user's facility or at YSI, the following steps must be taken to insure the safety of our service personnel.

1. In a manner appropriate to each device, decontaminate all exposed surfaces, including any containers. 70% isopropyl alcohol or a solution of ¼ cup bleach to 1 gallon tap water are suitable for most disinfecting. Instruments used with wastewater may be disinfected with 0.5% Lysol if this is more convenient to the user.

2. The user shall take normal precautions to prevent radioactive contamination and must use appropriate decontamination procedures should exposure occur.

3. If exposure has occurred, the customer must certify that decontamination has been accomplished and that no radioactivity is detectable by survey equipment.

4. Any product being returned to the YSI Repair Center, should be packed securely to prevent damage.

5. Cleaning must be completed and certified on any product before returning it to YSI.

Packing Instructions

1. Clean and decontaminate items to insure the safety of the handler.
2. Complete and include the Cleaning Certificate.
3. Place the product in a plastic bag to keep out dirt and packing material.
4. Use a large carton, preferably the original, and surround the product completely with packing material.
5. Insure for the replacement value of the product.

Cleaning Certificate

Organization _____

Department _____

Address _____

City _____ State _____ Zip _____

Country _____ Phone _____

Model No. of Device _____ Lot Number _____

Contaminant (if known) _____

Cleaning Agent(s) used _____

Radioactive Decontamination Certified?

(Answer only if there has been radioactive exposure)

_____ Yes _____ No

Cleaning Certified By _____

Name Date

19. Appendix J–Required Notice

The Federal Communications Commission defines this product as a computing device and requires the following notice:

This equipment generates and uses radio frequency energy and if not installed and used properly, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class A or Class B computing device in accordance with the specification in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorient the receiving antenna
- relocate the computer with respect to the receiver
- move the computer away from the receiver
- plug the computer into a different outlet so that the computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 0004-000-00345-4.

YSI Life Sciences

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