

Does My Infutest Really Need Service?

This note hopes to address some of the more common problems encountered by our customers. By following these instructions, you should be able to diagnose most problems yourself and clearly determine if your Infutest is broken and needs to be repaired.

Why should you have to do without your Infutest if there's really nothing wrong with it?

"Occlusion pressure test doesn't work"

You can perform a very simple check to determine for yourself whether or not Infutest's Occlusion Pressure Test is "broken".

First, use your priming syringe to blow the water out of both channels. If the Infutest is powered down, turn it on (Infutest will produce a "WARNING: Unit unprimed" alarm, but that doesn't matter). Fill the priming syringe full of air and connect the syringe to the suspect channel. Then select and start an Occlusion Pressure Test.

If the test is working, you should hear a "click" as Infutest's occluder valve is energized. Now push on the syringe. You should be able to feel that the valve has blocked off the channel, and you should clearly see the pressure increasing on Infutest's display. If the valve isn't working, you won't feel any resistance while pushing on the syringe, and the pressure won't increase. If the valve is fine but there is something wrong with the electronics, you will feel resistance but the displayed pressure may not vary as you would expect.

When starting Occlusion Pressure Tests, remember to check that your pump is in fact pumping. Before starting the pump, you should always select a suitable rate (e.g. 100 ml/hr or higher). If the pump's rate is too low, it may take a very long time for the pump to develop a measurable pressure.

"Won't measure flow"

With this problem, you are able to start a test but no measurements appear on the LCD, even after several minutes. In the upper right corner of the LCD, Infutest may display "Measuring...", but the Flow, Average and

Volume readouts all show "--.--".

At flow rates above 10 ml/hr, Infutest should display results within 20 seconds after starting a test, *provided the pump you are testing is working properly*. If you know the pump is o.k., there may be a problem in Infutest's flow measurement system. In most cases you can diagnose the problem yourself, and sometimes you can even fix it yourself.

Infutest measures flow by injecting an air bubble into a glass capillary tube of calibrated volume. Optical sensors track the position of the bubble as it is pushed by the flowing water through the tube. Measurements displayed on the LCD are based on the time it takes the bubble to move from one optical sensor to the next. So each time you hear Infutest go "clunk" during a test, a bubble has just been injected into the tube.

If you can hear the injector "clunk" at the start of a test, you can be reasonably certain most of the flow measurement system is working properly. If you don't hear the "clunk" when you start a test, Infutest has an electromechanical problem and should be returned for service. (An electromechanical problem is very rare in units still under warranty).

If you can hear Infutest injecting bubbles, but the LCD does not display any measurements, then the injected bubble is not being released into the flow sensor, or it is getting "stuck" somewhere inside the sensor.

Although the mechanics of Infutest's air injector may be operating, no bubble will be released into the flow sensor if the injector is flooded with water. This can occur if one channel is inadvertently left open to atmosphere for a long time while the other channel is used to test pumps. The Infutest must be returned in this case to have the injector disassembled and the water blown out. If you have the time, you may want to drain all the water out of your Infutest and leave the unit for several days to "dry out". If the injector is not completely flooded, the water may evaporate by itself.

The bubble can get "stuck" in the Infutest's flow sensor if the wrong test fluid is (or was) used. Dextrose (D5W, D25W) and TPN solution, even if diluted with water, will coat the flow sensor with a sticky residue. If the walls of the sensor are sticky, the injected bubble will not flow and so no measurements will be displayed. The problem can be fixed by cleaning out the instrument

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Series C & Series D

thoroughly using the procedure given in the Application Note, *AN-014 - How to Clean the Infutest*.

If you have problems in measuring flow, always try cleaning your Infutest before you decide to return the unit for service. The problem may simply be due to sticky material in the Infutest's flow sensors. After cleaning, check the Infutest at about 50 ml/hr using a pump you are familiar with and you know is working.

Usage which results in flooding of the injector or contamination of the flow sensor directly contravenes instructions provided in the Infutest Operating Manual. Consequently, repair of these faults cannot be covered under warranty.

"Unit is out of calibration"

Erratic or erroneously low measurements displayed on the LCD are usually attributable to contamination of the flow sensors with D5W, D25W or another sticky, viscous liquid. Try cleaning your Infutest as described in the Application Note, *CLEANING YOUR INFUTEST*, before returning the unit to have the calibration checked.

In some cases, Infutest may display a flow which seems nearly *twice* the rate you set your pump at, or even higher. This is a fairly common complaint.

Excessively high flow rate measurements are almost always caused by an undetected air bubble in the flow sensor at the start of a test. It is always safest to flush the Infutest channel at the start of each and every flow test to purge any bubbles from previous tests that may be in the channel. This is discussed in more depth in the Application Note, *BRUSH BETWEEN MEALS, FLUSH BETWEEN TESTS*.

Cassette pumps are notorious for producing erratic flows when observed over short time intervals. In some cases, the cassette pump may produce a "flow burst" which is more than double the rate setting of the pump. For more about the peculiarities of testing cassette pumps, see Application Note, *TESTING CASSETTE PUMPS AT HIGH RATES*.

Tests results obtained with the Infutest will only be as good as the IV set or syringe installed in the pump under test. ***IV sets will quickly degrade and become inaccurate if left installed in a pump for more than 48 hours. The lubricant used on the plungers of disposable syringes washes away over time,***

making them useless for syringe pump testing. A new syringe should always be used in a syringe pump test, and pump IV sets should be treated with care and replaced after 48 hours of intermittent testing. More information on pump IV sets can be found in Application Note, *PUMP IV SETS AND SYRINGES*.

Except for syringe pumps, most medical infusion devices produce uneven flow which includes short-term "deviations". The degree of fluctuation depends on the pump design and "vintage", and the flow rate. ***For some cassette pumps, instantaneous deviations of +/- 50% from the rate setting should not be considered unusual at higher flows.*** Linear peristaltic pumps are somewhat better at higher rates, but older models can become erratic in their delivery at rates below 20 ml/hr. Generally, the Average Flow displayed on the Infutest should converge to the rate setting of the pump within 10 minutes or less.

If you are concerned about the calibration of your Infutest, try running a Single Rate Test on a SYRINGE pump you feel confident is in good working order. Install a new syringe in the pump before testing, and set the pump to infuse at 50 ml/hr. Start the syringe pump first and allow it to run for a minute or two so that mechanical slack in the lead screw drive is taken up. Then, start the Single Rate Test. ***Because of tolerances in the diameter of disposable plastic syringes, the Average Flow you measure with Infutest may differ from the pump setting by as much as +/- 5%.*** However, if your Infutest is working properly, the test results should clearly show the smooth, highly continuous flow which is characteristic of acute care syringe pumps. You should expect the FLOW graph that Infutest displays to show a nearly flat, horizontal line.

The PRESSURE SENSOR ZERO Alarm

You should ensure no fluid pressure is applied to Infutest when you first turn the instrument on. This is important because Infutest attempts to zero the offset of its pressure transducers as part of an internal power-on self-test.

Remember, if you allow gravity free-flow through a pump from an IV bag to the Infutest, you will be applying a pressure to the instrument by virtue of the head created by elevation of the IV bag. Install the set into the pump to stop the free-flow and eliminate the pressure head before turning on the power to the Infutest.

The NVRAM BATTERY Alarm

A 3 volt lithium battery is used to power Infutest's time/date clock and a 32K RAM chip when the power is disconnected. The battery-backed RAM of the Infutest contains the AutoSequence programs, and also the results of the last test stored in the data logs of each channel. The clock/RAM battery should have a lifetime of about 18 months, and will last longer the more you use your Infutest!

The NVRAM BATTERY alarm is produced upon power-up if one of a few selected memory locations in the RAM was changed while the power was off. Sometimes, one of these memory locations can be changed by power-up transients or by mild electrostatic discharges. The battery may in fact be fine.

You should ensure your battery really needs replacing by turning the power off, waiting about two minutes, and then turning the power back on. Repeat this test a few times. If you get another NVRAM alarm, the battery should be replaced.

The NVRAM battery is commonly available and the replacement procedure is fairly simple. Replacement instructions may be obtained from our service representative at 800-667-6557.

AutoSequence Problems

Since the battery-backed RAM is used to store the AutoSequence programs, a loss of battery power resulting from a dead battery or a poor battery connection also means your Infutest AutoSequences may be corrupted.

If you are using the default AutoSequences supplied with the Infutest, you can easily reload these into the RAM by powering up the instrument while holding down the front panel key second from the left. This is probably the easiest method of recovery from a bad battery, if you have only made minor edits to the default AutoSequences.

If you have reprogrammed most of the AutoSequences to suit yourself, you should consider backing them up to your PC in case you eventually get a battery problem. Datrend Systems provides a free utility program for this purpose. The program may be downloaded from the Datrend Systems web page at

<http://www.datrend.com>

InfuEdit is a Windows program that provides a full-screen editor for programming, uploading and downloading Infutest AutoSequences to or from your PC.