Technical Update


TROUBLESHOOTING

Equipment Type: Phoenix® Dialysis System

Subject: Troubleshooting Art/Ven and T1T Art/Ven Pressure Problems

From: Gary Willis

Purpose: To assist technicians in troubleshooting problems related to Arterial and Venous Pressure measurement and T1T Arterial and Venous Test and Calibration.

Signal Path Background: The PIB board receives pressure information from the Arterial and Venous Pressure Sensors (load cells) at connectors P3 (Arterial) and P4 (Venous). The pressure signals are amplified and leave the PIB board through the connector P2. A gray cable carries the pressure signals to the J19 connector on the Phoenix motherboard. The signals are then passed to the Protective and Blood boards, which digitize the signals and forward the digital data to the CPU for display on the screen. (See Figure 1)

Measurements: Each pair of signals, VBP- and VBP+ (P2-1 and P2-2) for Venous pressure, and ABP- and ABP+ (P2-3 and P2-4) for Arterial pressure carries the pressure data to motherboard connector J19 (same pin #s as P2).

The voltage variations due to pressure changes as measured at P2 or P19 are very small, where a 40 to 50 mmHg pressure change corresponds to a voltage change of only 1 mV DC. To observe the venous or arterial voltage change, connect the negative (black) DVM lead to the negative pressure signal and the positive (red) DVM lead to the positive pressure signal. The Venous Pressure voltage will be 0 mV at 0 mmHg and will increase approximately 1 mV for every increase of 40 to 50 mmHg of pressure applied to the Venous Pressure Sensor. The same measurement ranges are true for the Arterial Pressure voltage, except the measured mV values will be negative, becoming more negative with greater applied negative pressure.

The above measurements can be observed by applying pressure through the A/V Test Cartridge, but can also be simulated and observed by using the calibration screens for the T1T Arterial or T1T Venous Pressures. A resistor bridge circuit on the PIB board is used during T1Test 14 to simulate a high venous and low arterial pressure to test the pressure measurement circuits of the Blood and Protective Slave boards. The voltages generated by this test circuit on the PIB board are indistinguishable from those generated when applying pressure to the Arterial and Venous pressure sensors.

Troubleshooting: In the majority of cases, swapping pressure sensors, or PIB, Protective, and Blood boards will quickly identify which component is at fault. In the case of T1T Art or Ven calibration values that cannot be
changed or increased/decreased beyond a certain point, the likely cause is a failed PIB board. However, if component replacement proves unsuccessful and you continue to experience an unstable pressure measurement or a calibration that doesn’t seem to hold, then the problem could be related to a supply voltage problem or poor connections at P3, P4, or a bad cable or connections at P2 / P19.

Verify that the supply voltages used by the PIB board are correct. Verify on the motherboard that 5VP, 5VD, and 5VB meet specifications (4.95V is too low). Verify the +15V and –15V supply voltages. If any of these voltages are out of spec, then first troubleshoot the J37 connection or replace the cable, before considering replacing the power supply.

Since the displayed pressure measurements are derived from very small5 mV signal changes, then oxidized connections could have a considerable negative impact on the stability of the measured pressure. For suspected connection issues, reseat the Protective and Blood Slave boards, check and clean the female pins on the P3 and P4 connectors and the P2 / J19 cable connectors with a contact cleaner spray and then apply Stabilant 22 to the connections. If this is unsuccessful, then try replacing the P2 / P19 cable. Re-test / re-cal as needed to confirm improved pressure measurement / calibration stability. **Note: The P2 / J19 cable is currently not a spare part. If you need this cable then contact Customer Service to request it from the manufacturer.**

If you have any questions, please contact Gambro Technical Assistance Services at 800-525-2623.