

March 2008

T007: Procedure to check sensors on sample and reagent pumps.

## Sample, acid and base pump sensors in the BioTector TOC Analyzer.

### Operation:

The sample, acid and base pumps in the BioTector TOC Analyzer contain sensors which are used for stopping the pump with the rollers in the horizontal position, and also for measuring the rotational speed of the pump.

These sensors are hall-effect sensors, with the sensor and associated electronics embedded in the pump. The magnets which trigger the sensors are embedded in the rotors of the pumps.

### Control and fault generation:

The BioTector monitors the stopping position of each pump, and also its rotational speed.

- If the stopping position is not correct, for example if the relay switching the pump is worn, and it does not stop on the sensor with the LED lighting, a **PUMP NOT SYNC** error is generated.
- If the pump does not rotate at the correct speed, or rotate at all, then one of the following 2 error messages will be generated:  
**PUMP SEN LOW or PUMP STOP ON**, this means that the pump has stopped in such a position that the sensor is always on, and it's LED is lighting.  
**PUMP SEN HIGH or PUMP STOP OFF**, this means that the pump has stopped in such a position that the sensor is always off, and it's LED is not lighting.

### Resetting faults on these pumps:

In general, the fault can be reset by selecting the appropriate fault in the Fault Archive, and pressing the Enter Key on the BioTectors keyboard. The BioTector will then run the pump for one half-revolution, and confirm that its operation is correct.

If the fault does not reset, please proceed as follows:

1. Power down the BioTector, wait 30 seconds, power up the BioTector and try to reset the fault. This will clear the system of any possible software error preventing the fault from being reset.
2. If this is not effective, the pump must be checked.
3. Is the pump rotating?  
Run the pump in the Process Simulate menu for 40 pulses (for the sample pump, you must first select the SLOW mode, this is not necessary for the acid or base pumps), and confirm that the pump is physically rotating. If the pump is not rotating, replace the pump. Please see the photograph on the next page:



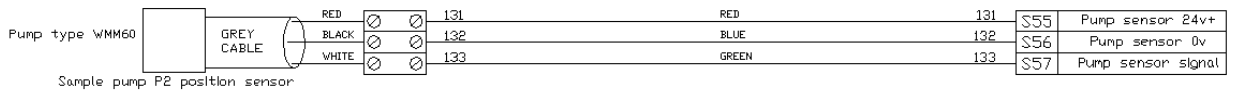
Location of Sample, Acid and Base pumps.

4. Is the sensor operating?

Run the pump in the Process Simulate menu for 40 pulses (for the sample pump, you must first select the SLOW mode, this is not necessary for the acid or base pumps), and confirm that the LED associated with the pumps sensor is lighting as the magnet crosses the sensor. The LED should light briefly around once every second, when the pump rollers are horizontal. If the LED is lighting, the sensor is operating. If the LED is not lighting, see section 5. Please see the photograph below:



5. If the LED is not operating, confirm that the power to the sensor is ok. Please see the drawing below. You should have 24V DC between wires 131 and 132, both at the signal PCB (terminals S55 and S56), and in the terminal block in the trunking behind the pump. When the magnet is in front of the sensor (when the rollers are horizontal), there should be approximately 5v between wires 132 and 133. When the magnet is not in front of the sensor, there should be approximately 21v between wires 132 and 133. If the power is ok, but the sensor is not operating, replace the pump.



6. Is the Microcontroller seeing the sensor signal? In the Maintenance menu, select the Digital Input section of the I/O Status menu. In this menu, you can see the operation of the pumps sensor. To see the state of the sensor change from 1 to 0 and back again, turn the pump you are testing by rotating the roller section of the pump by hand. When the LED is lighting, the Digital Input state will be 0. When the LED is not lighting, the Digital Input state will be 1. If the Digital Input in the I/O status menu does not change state, then the most likely cause is the ribbon cable linking the Signal PCB to the Microcontroller. Contact PCS for assistance.

DIGITAL INPUTS				09:17:28 12-09-02			
DI01 = 1	DI02 = 1	DI03 = 1	DI04 = 0	DI05 = 0	DI06 = 1	DI07 = 1	DI08 = 1
DI09 = 1	DI10 = 1	DI11 = 1	DI12 = 1	DI13 = 1	DI14 = 1	DI15 = 1	DI16 = 1
DI17 = 1	DI18 = 1	DI19 = 1	DI20 = 1	DI21 = 1	DI22 = 1	DI23 = 0	DI24 = 0
DI25 = 1	DI26 = 1	DI27 = 1	DI28 = 1	DI29 = 1	DI30 = 1	DI31 = 1	DI32 = 1

Key:  
DI04 = Sample Pump sensor  
DI05 = Acid Pump sensor  
DI06 = Base Pump sensor

7. Is the Pump Setup Menu correct?

Run the pump in the Process Simulate menu for 40 pulses (for the sample pump, you must first select the SLOW mode, this is not necessary for the acid or base pumps), and with a stopwatch, record the time the pump runs. Divide this time by 40 to get the time for each half revolution (pulse).

For a BioTector with WWM60 pump, and no speed control card, this should be between 0.45s and 0.55s. If it is greater than this, the pump may be partially seized, and should be replaced.

Confirm that the setting in the System Configuration / Pump Setup menu, line 3, matches your calculation. Please see this menu on the next page, showing a setting with the default 0.48s in the first column of line 3.

Confirm that line 1 in this menu, Sample Type, is set to Symmetric.

PUMP SETUP		09:17:28	12-09-02
1 <	SAMPLE TYPE	SYMMETRIC	
2	SAMPLE PULSE CONTROL	YES	
3	SAMPLE PULSE TIME	0.48s [0.47s]	
4	SAMPLE PULSE VOLUME	0.30ml	
5	ACID PULSE CONTROL	YES	
6	ACID PULSE TIME	0.50s [0.49s]	
7	ACID PULSE VOLUME	0.22ml	
8	BASE PULSE CONTROL	YES	
9	BASE PULSE TIME	0.50s [0.46s]	
10	BASE PULSE VOLUME	0.22ml	
11	SIV ADJUST	000	
12	SMPL INJECTION	FORWARD	
13	MANUAL MODE SPR	NO	

If the default setting in the first column of line 3 is not 0.48s, set this to 0.48s.

The setting in square brackets is the actual running speed, and should be the same as the time you calculated.