Understanding the HVPS true air speed clock on the SEA M200/M300 data systems

Determining True Air Speed

Knowing how the true air speed clock frequency is set in the SEA M200 data system requires knowledge of the probe resolution and the true air speed. From this, the true air speed clock frequency to the probe is:

$$T_{FREQ} = TAS / RES$$

where TAS is the true air speed in meters per second, and the resolution is the probe resolution in meters. For example, for the HVPS, the probe resolution is $200 * 10^{-6}$ meters, so, at 50 meters per second, the true air speed clock frequency would be 250 KHz. Incidentally, this is the maximum clock frequency to the probe, which will be discussed later.

The M200 data system determines the probe resolution of the HVPS from a line in the file CTLTBL.TXT, the contents of which is shown below. The highlighted line is where the resolution of the probe is stored, which allows the user to change this value. The probe resolution, determined by the optics that implement the imaging of a particle, will not change; however, as described next, there is a reason one might want to change the resolution as defined in the file. In the file shown, the line that sets the resolution is emboldened. Note that the resolution is given in units of microns, or 10^{6} meters.

```
;*****************************************************************************
;* CTLTBL.TXT, Chapter 16
;*                      CONTROL TABLE
;*
;* Revised:  Oct. 26, 1998
;* Description     Number State Refresh  Control
;*****************************************************************************
2DCTASClock          0    1      1 CTLTAS2D(0, F5, 33.0)
HVPSTASClock         1    1      1 CTLTAS2D(1, F7, 200.0)
;RTI802              2    1      1 RTI802DA(F600,0,1,0x340)
;RTI802              3    1      1 RTI802DA(F601,1,1,0x340)
;RTI802              4    1      1 RTI802DA(F602,2,1,0x340)
;RTI802              5    1      1 RTI802DA(F603,3,1,0x340)
RTI802               6    1      1 RTI802DA(F584,2,1,0x340)
RTI802               7    1      1 RTI802DA(F585,3,1,0x340)
;* end of file
```

Because the HVPS needs to see a 50% duty cycle clock, the card that produces the true air speed clock for the HVPS has been modified by SEA, with the result that the clock frequency one expects from the explanation above will be halved. Figure 1 below shows an example of this. The effect is that the aspect ratio of particles will be 2:1 instead of 1:1. The modified true air speed clock frequency is thus:

$$T_{FREQ} = TAS / (2*RES).$$

So, changing the line in the CTLTBL.TXT file to read

```
HVPSTASClock         1    1      1 CTLTAS2D(1, F7, 200.0)
```

will ensure a correct true air speed clock for the probe.

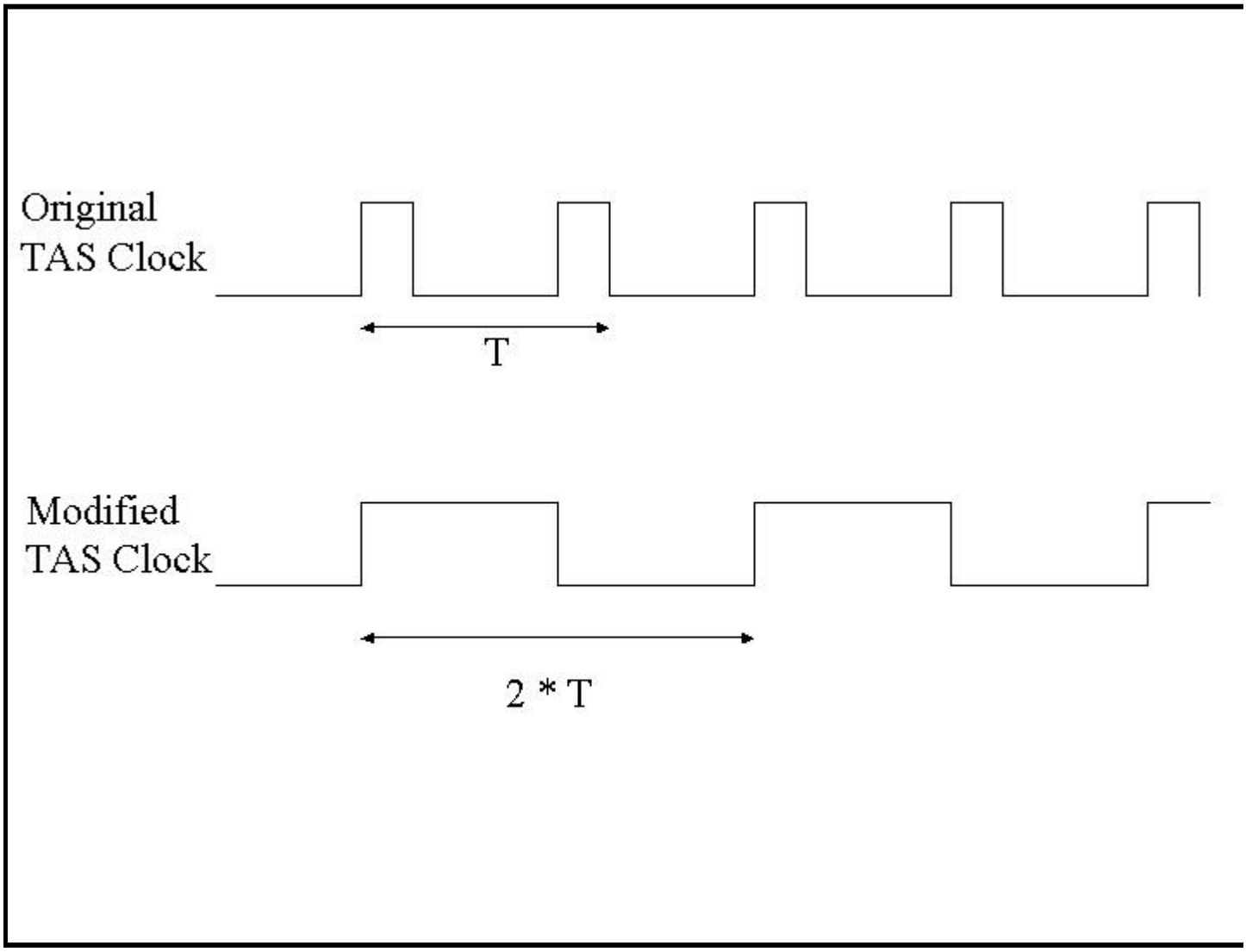

Figure 1: Original and modified true air speed clock from the M200 data system.

Using the modifications to your advantage

Since the probe is limited to a true air speed clock frequency of $250 * 10^3$ Hz, the maximum true air speed the probe can image at correctly is:

$TAS = 250 * 10^3 * 200 * 10^{-6} = 50$ meters per second.

However, this is assuming the original clock of the M200 system. With the modified true air speed clock (see figure 1), the fastest true air speed is effectively doubled to 100 meters per second. Many users routinely fly faster than 50 meters per second, so, at the expense of an aspect ratio of 2:1 for imaged particles, the system can be left as is when received (the probe resolution left at 200 microns), and see particles at up to 100 meters per second. If, however, the probe resolution is changed to 100 microns, so the true air speed clock frequency is correct going to the probe as previously discussed, the probe will image all particles with an aspect ratio of 1:1

up to 50 meters per second; after the true air speed goes over 50 meters per second, the aspect ration will be defined by:

(TAS/50) : 1.