PART III

Assessing the Equipment

The growth of particle counting in the drinking water treatment industry has brought about many changes in the technology in the past few years. The first particle counters sold to water plants were modified laboratory units, which worked acceptably but were not tailored to the specific requirements of the application. As the initial trickle of interest swelled into a flood, more attention was directed toward developing suitable equipment.

At present, there are five manufacturers offering standard light-blocking particle counters and systems to the drinking water industry. This part of the book takes a comparative look at the main equipment offerings of four of them. The fifth, ATI, offers only a single-channel particle alarm. The intent is not to present a “good, better, best” rating system, but to present the relevant information in a readily accessible format to allow the reader to make assessments for each given application, with the information from the first two parts of this book as a guide. Any subjective observations about the utility of certain features or assessments regarding ease of use should be taken as opinions of the author.

Specifications are taken from the manufacturers’ published literature, and no endorsement of their accuracy is implied. We heartily recommend that information be obtained from the manufacturers before any purchasing decisions are made, both for the reason that the information presented here will be out-of-date sooner or later, and because some of the specific features of a given product may have a rationale not covered by the material presented here. This book is not intended to provide an easy way out of the complicated task of specifying or buying a particle counting system. It is merely intended to leave the reader without excuse for an ill-informed decision.

Actual performance testing is beyond the scope of this book. Studies in that area are being performed, and some of them will be referenced in Appendix 2.

A listing of the current manufacturers is provided in Appendix 1. To account for some of the equipment still found in water plants, which may not be mentioned in
this book, a thumbnail sketch of the history of the particle counting manufacturers involved in the water treatment industry follows.

The first particle counters were used in water treatment for research in the late 1970s, and were made by a company named Hiac Royco. These instruments predated the invention of the laser diode, and employed an incandescent white light source.

Little was done in drinking water with particle counters until the late 1980s when a major Cryptosporidium outbreak in Carrollton, Georgia, prompted the state health department to look into particle counting as a means of monitoring filters for preventing similar occurrences. By this time, laser diode technology had been introduced, making the instruments much more reliable. Hiac Royco was still a major supplier of particle counters, and a second firm named Met One was also situated to provide particle counters for water treatment applications.

The interest in online particle counting was boosted further when Georgia began strongly encouraging many of its plants to install particle counters. Plants in California and a few other states also began to investigate particle counting quite seriously. A third manufacturer, Particle Measuring Systems, also known as PMS, which was well established in particle counting in the pharmaceutical industry, began offering an online particle counting system. At about the same time, the Hach Company, long the leader in drinking water turbidimetry and a major supplier of many other laboratory and process instruments, began selling a portable grab sampler manufactured by Hiac Royco. For a brief period of time, Great Lakes Instruments marketed particle counters made by Met One.

In 1994, Chemtrac Systems, a small firm known primarily for streaming current instrumentation, introduced a line of particle counting equipment, making them the first established drinking water instrumentation company to do so. In early 1996, the Hach Company began marketing an online particle counting system manufactured by PMS. As part of this agreement, PMS ceased any direct marketing in the water treatment industry.

In the biggest “off-field” development in the particle counting industry, around the end of 1995, Pacific Scientific Instruments, the parent company of Hiac Royco, purchased Met One. The ever-vigilant U.S. Department of Justice forced Pacific Scientific Instruments to sell off the Hiac Royco water treatment particle counting product line to another manufacturer, to prevent a “monopoly” in the drinking water industry. This despite the presence of Hach and Chemtrac and somehow in ignorance of the virtually complete dominance that Hiac Royco and Met One maintained in the even more lucrative hydraulics market. Somewhat reminiscent of Br'er Rabbit’s admonition to “throw me in the brier patch,” this move allowed Pacific to unload the increasingly uncompetitive Hiac Royco water line while remaining untouched in an industry of much greater import.

The Justice Department mandate required that the Hiac Royco line be placed with another firm with the assurance that it would maintained as a viable entity in the market. Inter Basic Resources (IBR) successfully bid for it, and has continued to market it in the drinking water industry. IBR has provided equipment related to particle counting for several years, and was a logical choice for taking over from Hiac Royco.
Just when things seemed to be settling down, two more changes have altered the particle counting landscape. The Hach Company was purchased by the parent company of Pacific Scientific Instruments, and will end its arrangement with PMS. Hach will now market the main Met One product line exclusively in the drinking water market, with Met One still active with a few of the products, as well as in other markets.

A new particle counting company emerged in 1998, Art Instruments, Inc. (ARTI), of Grants Pass, Oregon. ARTI has developed a full line of particle counting equipment for air and liquid applications. It is currently marketing drinking water systems through US Filter in North America.

At the time of writing, the current manufacturers offering particle counting equipment in the drinking water industry are Met One, Chemtrac, Hach, IBR, Art Instruments, and ATI. ATI is a drinking water instrument manufacturer that is just beginning to offer a single-channel particle counter. As is typical of “niche” markets such as particle counting, there is a good bit of “cross-pollination” between the particle counting firms, as employees change employers and bring the technology with them. Although several firms are now involved in providing particle counters, almost all of the expertise has been developed at Hiac Royco, Met One, and PMS. It is interesting that only one of these three is still even indirectly involved in the drinking water industry.
CHAPTER 15

Specifications

Table 15.1 provides a side-by-side comparison of the published specifications for the primary instruments discussed in Part III.

A. MET ONE PCX

The Met One PCX will be marketed exclusively by Hach in North America as the Hach 2200 PCX. It will be referred to by the Met One model name in this book, since it has already been on the market for a number of years. The other Met One models will still be sold by Met One. See Figure 15.1.

B. CHEMTRAC PC2400D

The Chemtrac PC2400D is the online instrument offered by Chemtrac. See Figure 15.2.

C. ART INSTRUMENTS

Art Instruments manufactures the WPC 1000 and WPC 2000. These instruments are identical except for sensitivity and flow rate. See Figure 15.3.

D. IBR WPCS

The IBR WPCS was originally designed and sold by Hiac Royco. The WPCS-01 has a smaller flow cell designed for higher concentrations than the WPCS-11.
<table>
<thead>
<tr>
<th>Specification</th>
<th>ARTI WPC 2000</th>
<th>ARTI WPC 1000</th>
<th>Chemtrac PC2400D</th>
<th>Met One PCX</th>
<th>IBR WPCS-01</th>
<th>IBR WPCS-11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>2µm</td>
<td>1µm</td>
<td>2µm</td>
<td>2µm</td>
<td>2µm</td>
<td>2µm</td>
</tr>
<tr>
<td>Signal/noise</td>
<td></td>
<td></td>
<td>3:1 @ 2µm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>a</td>
<td>b</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Coincidence</td>
<td>&lt; 10% @ 15,000/ml</td>
<td>&lt; 10% @ 25,000/ml</td>
<td>&lt; 10% @ 15,000/ml</td>
<td>—</td>
<td>&lt; 10% @ 18,000/ml</td>
<td>&lt; 10% @ 12,000/ml</td>
</tr>
<tr>
<td>Sizing range</td>
<td>2 to 100 µm</td>
<td>1 to 25 µm</td>
<td>2 to 70 µm</td>
<td>2 to 50 µm</td>
<td>2 to 125 µm</td>
<td>2 to 40 µm</td>
</tr>
<tr>
<td>Sample flow range</td>
<td>50 to 110 ml/min</td>
<td>45 to 55 ml/min</td>
<td>50 to 120 ml/min</td>
<td>100 ml/min nominal</td>
<td>25 ml/min nominal</td>
<td>60 ml/min nominal</td>
</tr>
<tr>
<td>Flow cell dimensions</td>
<td>800 µm × 800 µm</td>
<td>600 µm × 600 µm</td>
<td>1 µm × 1 µm</td>
<td>750 µm × 750 µm</td>
<td>125 µm × 1000 µm</td>
<td>400 µm × 1000 µm</td>
</tr>
<tr>
<td>Volumetric/ in situ</td>
<td>Volumetric</td>
<td>Volumetric</td>
<td>Volumetric</td>
<td>Volumetric</td>
<td>Volumetric</td>
<td>Volumetric</td>
</tr>
</tbody>
</table>

a Counting efficiency: 50% at 2 µm (30 to 70% window) 100% at 5 µm in the 2 µm threshold (80 to 120% window).
b Counting efficiency: 50% at 1 µm (30 to 70% window) 100% at 2 µm in the 1 µm threshold (80 to 120% window).

Note: Counting efficiency is an alternative way to look at resolution and, by implication, signal/noise. Ideally, half of the particles should fall on either side of the threshold for a given size, and none of the particles in the next highest size range. If this is achieved at the sensitivity of the sensor, it indicates a sufficiently high signal-to-noise ratio.
Figure 15.1 Met One PCX particle counter. (Courtesy of Pacific Scientific Instruments, Grants Pass, OR.)

Figure 15.2 Chemtrac PC2400D particle counter. (Courtesy of Chemtrac Systems, Inc., Norcross, GA.)
Figure 15.3 ART Instruments particle counter. (Courtesy of ART Instruments, Grants Pass, OR.)