

# Purge & Trap Product Playbook

This playbook demonstrates how Teledyne Tekmar P&T instruments can expand your product portfolio and gain market share for you. At Teledyne Tekmar, we provide solutions for a wide range of P&T challenges!



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## Introduction

Teledyne Tekmar's Purge and Trap (P&T) systems are designed to perform primary sample preparative EPA Methodologies for Wastes 5030 (waters) and 5035 (soils) in addition to Drinking Water Method 524 series and Wastewater Method 624. All of these methods are for the determination of Volatile Organic Compounds (VOCs). Currently Teledyne Tekmar produces three Purge and Trap products for these methods:

- The Lumin stand-alone P&T concentrator is an 8<sup>th</sup> generation system and is based on the Stratum P&T concentrator.
- The Atomx XYZ Purge and Trap Concentrator with Multi-Matrix Autosampler Platform is a 2<sup>nd</sup> generation system and is based on the Atomx P&T concentrator with multi-matrix autosampler. The Atomx combined the Stratum and a soil/water autosampler into one unit.
- The AQUATek LVA is a waters-only autosampler with chilling tray and internal standard vessels. It is designed to work in conjunction with the Teledyne Tekmar Lumin and Stratum (Discontinued). It is a 5<sup>th</sup> generation liquids only, vial autosampler.

## Teledyne Tekmar P&T Milestones

- First to introduce a commercial P&T concentrator.
- First to introduce an automated methanol extraction.
- 40 Plus years of manufacturing P&T products.
- First to use an electronic Mass Flow Controller (MFC).
- At the time of this publication, Teledyne Tekmar has shipped thousands of systems worldwide!

## Objectives of the P&T Playbook

- Explain the basic principles of the P&T instrumentation.
- Explain the primary features and benefits of Teledyne Tekmar P&T systems.
- Define the key sales message.
- Identify target markets and potential customers.
- Identify customer requirements and align them with our products.
- Explain how our systems are positioned against competitor's products in the marketplace.
- Assist you in reaching new customers and extracting a market share from your competitors.

## What is Purge & Trap (P&T)?

### Theory

The ability to analyze VOCs is a vital part of environmental monitoring, outgassing studies, and flavor and fragrance analysis, among others. P&T is a technique that separates VOCs from a matrix. After separation, the VOCs are then concentrated and injected into the Gas Chromatograph (GC) for separation and detection. While gas chromatography is a very powerful analytical tool, it does have several limitations. P&T instrumentation is designed to overcome those limitations:

- Lack of sensitivity - GC detectors provide remarkable sensitivity. However, there are a number of areas where greater sensitivity is necessary, including:
  - Environmental Analysis- Many pollutants must be measured at low (ppb) levels, sometimes in the sub-part-per-billion (ppb) range.
  - Flavor and Fragrance Analysis- The human nose is one of the most sensitive detectors in existence. To provide an analytical system with comparable sensitivity, a method of concentration is required.
- Inability to tolerate liquid water direct injections - Many GC columns and detectors do not perform well in the presence of water. Water may drastically reduce the lifetime of the column and adversely affect detector performance.
- Gas chromatography requires a sample in vapor/vaporizable form and operates as an interaction between vapor and liquid phases. The sample must start out as a vapor. For this reason, many samples, (pollutants in soil or flavors in solid food) cannot be directly introduced into a GC.

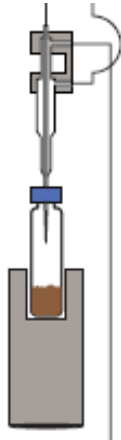
### Purge and Trap Operation

A measured amount of sample is placed in a sealed vessel into which an inert gas is introduced. The inert gas then “purges” the VOCs from the sample and sweeps them onto a sorbent analytical trap, where they are retained. To “desorb”, or release the VOCs from the analytical trap, the trap is heated. The trap is then back-flushed with carrier gas and the desorbed VOCs are injected into the GC. The GC then separates and detects the VOCs. A typical P&T system consists of:

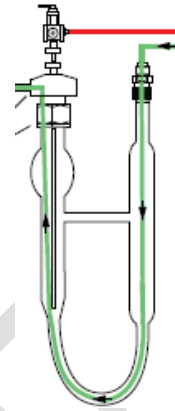
- An automated sample delivery system
- A liquid or solid sample that has been collected from the field and preserved
- A glass purging device
- An analytical trap
- A water management system or moisture control system
- A flow controller to regulate purge gas
- A heated switching valve
- A heated transfer line to the GC
- A human interface for instrument control and data display/data storage such as a computer with software.

## Sample Introduction/Purging/Water Removal

Concentration begins with manual or automatic introduction of the sample into a glass purge vessel. Pictured below are typical options for soil and liquid purge.

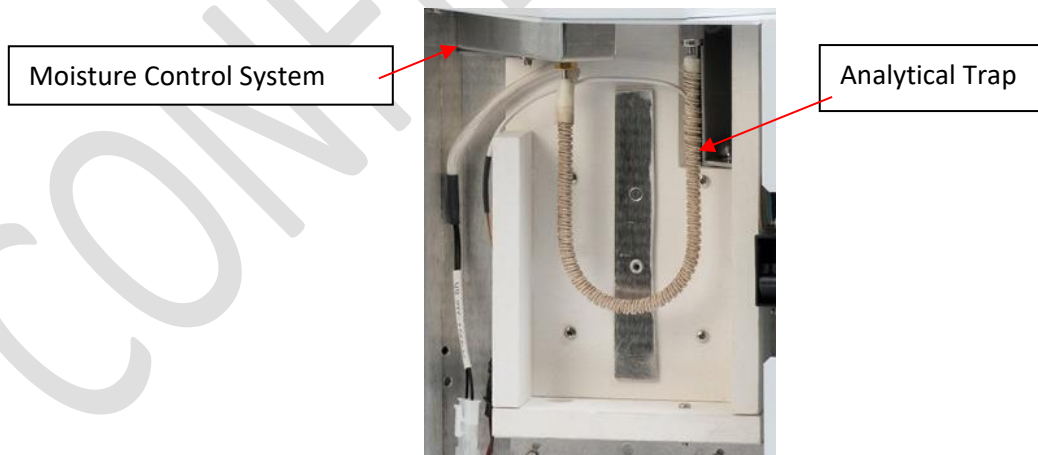


**Figure 1** Soil Purge in Vial



**Figure 2** Liquid Purge in Sparger

The purge flow extracts the VOCs from the sample and is routed through a water management device (Moisture Control System) and deposited on a sorbent analytical trap, at ambient temperatures. The Atomx XYZ and Lumin MCS/analytical trap design are shown in Figure 3.



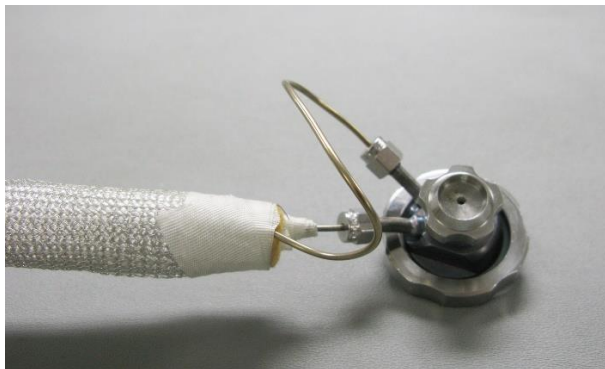
**Figure 3** Lumin MCS and Analytical Trap

## Desorption/GC Transfer

Once the purge is complete, the VOCs are thermally desorbed from the trap and transferred to the GC by routing the pressure regulated GC carrier gas through the heated trap of the P&T concentrator, using a heated switching valve and transfer line (shown below).

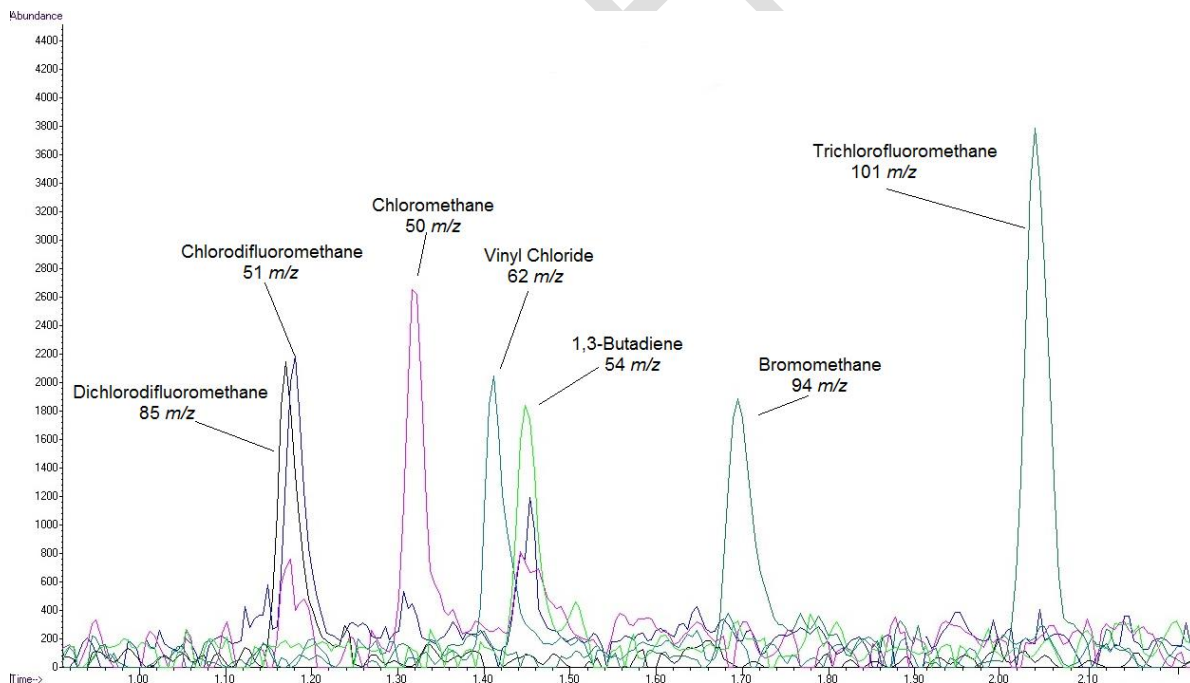


**Figure 4** Heated 6-Port Switching Valve



**Figure 5** Heated Sample Transfer Line GC Connection

Once transferred to the GC, the vaporized sample is injected and the VOCs are separated and detected. The GC software then shows the results in a chromatogram.



**Figure 6** Chromatogram showing VOC peaks using Method 524.3.

## P&T Instrument Control and Software Design

P&T analysis requires a large amount of flexibility to customize method settings and parameters (i.e. heat, time, gas flow rate, etc.). Additionally, the configuration of automated analytical sequences needs to be capable of applying these settings in an organized manner to a large amount of samples, and then generating easily understood results. Consequently, the software interface controlling the instrument must be robust, but still easy to navigate and configure. At a minimum, the software must be able to:

- Software should be able to control all the parameters required for the P&T process, including auto-sampler functions, if configured.
- Offer traceability of the process and any modification changes to the methods or schedules, to ensure dependability of the final data.
- Be easy to use and as robust as possible.
- Incorporate features that “add value” to the user, including leak checking, diagnostics and sample history.

## Teledyne Tekmar P&T Product Overview

| Table I Purge and Trap Product Line  |   |   |
|--|---|---|
| <p><b>Atomx XYZ Combination P&amp;T Multi-Matrix Autosampler</b></p>  | <p><b>Lumin Stand-Alone Purge and Trap Concentrator</b></p>  | <p><b>AQUATek LVA Liquid Vial Autosampler</b></p>  |

A P&T system should be easy to operate, fast, accurate, reproducible, reliable, specific, sensitive and flexible of technique in multiple matrices. Note: All instruments require a PC with CD-ROM drive running Microsoft Windows® 7 or newer and the appropriate GC or GC/MS interface cable.



## Lumin Purge and Trap Concentrator Stand-Alone System

| Table II Lumin Purge and Trap Concentrator Stand-Alone System |  |
|---|--|
| Part Number   | System   |
| PN 15-2500-100<br>(115VAC)<br>PN 15-2500-200<br>(230VAC)      | <b>Basic Lumin Sample Concentrator</b><br>Includes 60" Siltek® heated transfer line, inert tubing and Siltek® treated fittings throughout the sample pathway, heated sample mount, moisture control system (MCS), U-Trap technology, glassware bypass injection port, 5 ml frit sample sparger, Vocarb® 3000 trap, #9 trap, spare fuses, instruction manual, and USB interface capability. Includes Lumin TekLink™ software.   |
| PN 15-2500-1E0<br>(115VAC)<br>PN 15-2500-2E0<br>(230VAC)      | <b>Lumin Sample Concentrator with Factory Installed Guardian Foam Sensor &amp; Eliminator</b><br>Includes 60" Siltek® heated transfer line, inert tubing and Siltek® treated fittings throughout the sample pathway, heated sample mount, moisture control system (MCS), U-Trap technology, glassware bypass injection port, 5 ml frit sample sparger, Vocarb® 3000 trap, #9 trap, spare fuses, instruction manual, and USB interface capability. Includes Lumin TekLink software. |

## AQUATek LVA Liquid Vial Autosampler

| Table III AQUATek LVA Liquid Vial Autosampler |   |
|---|---|
| Part Number                                   | System  |
| PN 15-3800-000<br>(Universal Voltage)         | <b>AQUATek LVA Liquid Vial Autosampler, universal voltage with 5 mL PEEK sample loop. Compatible with Lumin and Stratum PTC Stand-Alone Concentrators</b><br>AQUATek LVA Liquid Vial Autosampler, universal voltage with 5mL PEEK sample loop. Including 84 vial (40mL) capacity, 2 position variable dosing standard valves. Includes chiller tray, blank water reservoir, start up kit, required software for Lumin and Stratum operation, and 1 year warranty. |

## Atomx XYZ Purge and Trap with Multi-Matrix Autosampler Platform

| Table IV Atomx XYZ Purge and Trap with Multi-Matrix Autosampler Platform |   |
|--|---|
| Part Number  | System  |
| PN 15-3200-100<br>(115VAC)<br>PN 15-3200-200<br>(230VAC)                 | <b>Basic Atomx XYZ Automated Sample Prep System for Solids and Liquids.</b><br>84-vial position autosampler and built in Purge and Trap module with automated methanol extraction capability. System includes three standard spiking valves, mass flow controller, and a #9 analytical trap. Package includes Atomx XYZ TekLink, USB cable, 5 mL fritted glassware, water reservoir, installation kit box, and 1-year warranty.   |
| PN 15-3200-10C<br>(115VAC)<br>15-3200-20C (230VAC)                       | <b>Atomx XYZ Automated Sample Prep System for Solids and Liquids with Vial Chiller Tray.</b><br>84-vial position autosampler and built in Purge and Trap module with automated methanol extraction capability. System includes three standard spiking valves, mass flow controller, and a #9 analytical trap. Package includes Atomx XYZ TekLink, USB cable, 5 mL fritted glassware, water reservoir, installation kit box, and 1-year warranty. System also requires a re-circulating bath for cooling operation.  |
| PN 15-3200-1EO<br>(115VAC)<br>PN 15-3200-2EO<br>(230VAC)                 | <b>Atomx XYZ Automated Sample Prep System for Solids and Liquids with Factory Installed Guardian Foam Sensor &amp; Eliminator</b><br>84-vial position autosampler and built in Purge and Trap module with automated methanol extraction capability. System includes three standard spiking valves, mass flow controller, and a #9 analytical trap. Package includes Atomx XYZ TekLink, USB cable, 5mL fritted glassware, water reservoir, installation kit box, and 1-year warranty.  |
| PN 15-3200-1EC<br>(115VAC)<br>PN 15-3200-2EC<br>(230VAC)                 | <b>Atomx XYZ Automated Sample Prep System for Solids and Liquids with Factory Installed Vial Chiller and Guardian Foam Sensor &amp; Eliminator</b><br>84-vial position autosampler and built in Purge and Trap module with automated methanol extraction capability. System includes three standard spiking valves, mass flow controller, and a #9 analytical trap. Package includes Atomx XYZ TekLink, USB cable, 5 mL fritted glassware, water reservoir, installation kit box, and 1-year warranty. System also requires a recirculating bath for cooling operation. |

## Features and Benefits

### Lumin Purge & Trap Concentrator

| Table V Lumin Purge & Trap Concentrator Features           |   |
|--|---|
| Feature  | Benefit   |
| <b>USEPA Drinking Water Methodology Affiliation</b>        | The Teledyne Tekmar Stratum P&T concentrator was employed by the USEPA to collect data during the development of methods 524.3 and 524.4. There is a precedent to use Tekmar instruments for these methods. |
| <b>Electronic Mass Flow Controller (MFC)</b>               | Patented. Programmable flow rates for use with Helium or Nitrogen. Assures optimum purge performance. If the trap is degrading, intelligent pressure feedback indicates the need for replacement.           |
| <b>Faster Trap Cooling</b>                                 | Faster trap cooling time through dedicated ducting means shorter cycle times and more throughput.   |
| <b>Short Sample Pathway</b>                                | Less surface area improves peak shape. Three linear feet reduction compared to previous models.   |
| <b>Water Management – Advanced Moisture Control System</b> | Moisture Control System (MCS) transfers up to 60% less water to the GC (than the Stratum). Promotes longer column life and reduces stress on MS vacuum system.  |
| <b>Low Carryover</b>                                       | 1% or lower, depending on the application. Allows customer to run more “paying” samples, rather than clean-up samples.  |
| <b>Optional Foam Sensing and Elimination Option</b>        | Guardian Foam Sensor identifies sample foaming, stops purge, and Eliminator adds anti-foam agent.   |

## AQUATek LVA Liquid Vial Autosampler

| Table VI AQUATek LVA Liquid Vial Autosampler Features          |  |
|--|--|
| Feature  | Benefit  |
| <b>84 Position Autosampler</b>                                 | Maximum sample throughput and reliability.   |
| <b>Solid XYZ Automation</b>                                    | XYZ platform has proven to be highly robust, with in-house testing reporting no errors of any kind after over 1 year of simulated use. System uses self-lubricating lead screws and direct drive motors producing quiet movements that are smooth and precise. |
| <b>High-Temperature Rinse</b>                                  | A patented dual-stage water heater supplies 90° C water to rinse the sample pathway and reduce carry-over contamination.   |
| <b>Valve Manifold Block</b>                                    | Reduction of potential leak sources due to a precision-machined valve manifold block, ensuring a reliable and robust system.   |
| <b>Built in Chiller Plate</b>                                  | Cost savings to the customer.  |
| <b>Two, Zero-Waste, Programmable Internal Standard Vessels</b> | Cost savings and the option to use different volumes.  |
| <b>Superior Serviceability</b>                                 | Simplified design and compatibility with Atomx XYZ automation improves reliability of the AQUATek LVA and service engineer familiarity with product line.  |
| <b>Auto Blanking</b>   | Blanks are taken from the DI water reservoir, leaving vial positions for paying samples and increased throughput.  |
| <b>pH Probe (Optional)</b>                                     | The pH probe option allows users to measure and record pH values for all samples in a schedule.  |
| <b>Stackable Configuration</b>                                 | Stackable configuration minimizes the instrument footprint and saves lab bench space.  |
| <b>Barcode Scanning</b>  | Ability to connect to a standard barcode reader in order to scan vial barcodes and automatically have the vial ID number added into the TekLink schedule.  |

## Atomx XYZ Purge and Trap with Multi-Matrix Autosampler Platform

| Table VII Atomx XYZ Purge and Trap with Multi-Matrix Autosampler Platform Features |  |
|--|--|
| Feature  | Benefit  |
| <b>USEPA Drinking Water Methodology Affiliation</b>                                | The Teledyne Tekmar Stratum P&T concentrator was employed by the USEPA to collect data during the development of methods 524.3 and 524.4. There is a precedent to use Tekmar instruments for these methods.  |
| <b>Electronic Mass Flow Controller (MFC)</b>                                       | A patented design. Programmable flow rates for use with Helium or Nitrogen. Assures optimum purge performance. If the trap is degrading, intelligent pressure feedback indicates the need for replacement.   |
| <b>Valve Manifold Block</b>  | Reduction of potential leak sources due to a precision-machined valve manifold block, ensuring a reliable and robust system.   |
| <b>Single Needle Design</b>  | 3-stage needle controls all liquid and soil sample handling. Other auto-sampler systems employ two different needles.  |
| <b>Water Management – Advanced Moisture Control System</b>                         | Moisture Control System (MCS) transfers up to 60% less water to the GC (than the Stratum). Promotes longer column life and reduces stress on MS vacuum system.   |
| <b>Faster Trap Cooling</b>   | Faster trap cooling time through dedicated ducting means shorter cycle times and more throughput.  |
| <b>Single Platform VOC Sample Preparation</b>                                      | Combination P&T multi-matrix vial auto-sampler. Reduces cost when compared to purchasing a P&T and an auto-sampler. One software platform and no need to connect two systems.  |
| <b>Prep Ahead Sample</b>   | Improves throughput by preparing the next sample in the sequence, while the current one is being analyzed.   |
| <b>Multi-Matrix System</b>   | Drinking waters, wastewaters and soils all processed on a single platform. Can run multiple sample types in a single schedule.   |
| <b>Solid XYZ Automation</b>  | XYZ platform has proven to be highly robust, with in-house testing reporting no errors of any kind after over 1 year of simulated use. System uses self-lubricating lead screws and direct drive motors producing quiet movements that are smooth and precise. |
| <b>Automated Methanol Extractions</b>  | Customers prepare these extracts manually, which is labor intensive and increases cost. We are the only system on the market that fully automates this process. Additionally, the customer can add surrogate pre or post extraction automatically.             |

| Table VII Atomx XYZ Purge and Trap with Multi-Matrix Autosampler Platform Features |  |
|--|--|
| Feature  | Benefit  |
| <b>In-Vial Mixer Assembly</b>  | Allows a magnetic stir bar to be added to a sample vial to mix the soil sample during the purge process (or soil sample during methanol extraction). |
| <b>Three Zero-waste, Programmable Internal Standard Vessels</b>                    | Cost savings and the option to use different volumes, based on needs. Competition provides two as a standard configuration.                          |
| <b>Methanol Rinse</b>  | Methanol rinsing of entire system. Greatly reduces carryover, allowing more paying samples to be run.  |
| <b>High-Temperature Rinse</b>  | A patented dual-stage water heater supplies 90° C water to rinse the sample pathway and reduce carry-over contamination.                             |
| <b>Auto Blanking</b>   | Blanks are taken directly from a water reservoir, rather than a vial. This frees up vial positions for paying samples and increases throughput.      |
| <b>Dilutions</b>   | Up to a 100x dilution capability for high-level waters. Can be used to generate calibration curves from a single stock standard vial as well.        |
| <b>Optional Foam Sensing and Elimination Option</b>                                | Guardian Foam Sensor identifies sample foaming, stops purge, and Eliminator adds anti-foam agent.  |
| <b>Optional Vial Chilling Plate</b>  | Optional chilling plate allows sample vials to be held at temperatures down to 4° C until they are sampled.  |

## Software

**NOTE: If possible, demonstrate software functionality to the customer!**

Years of refinement make the TekLink software among the best in the industry.

| Table VIII Software Features                  |  |
|---|--|
| Feature                                       | Benefit  |
| <b>Ease of Use</b>                            | No special user training required. TekLink software runs in a Windows® software environment and uses familiar design principles and functionality. |
| <b>Efficient Method and Schedule Creation</b> | Intelligently designed Method and Schedule Screens allow efficient method configuration and quick creation of automated analytical schedules.      |
| <b>Integrated Autosampler Control</b>         | AQUATek LVA autosampler control through the AQUATek LVA Tab. Parameters include sample settings, rinse settings, and internal standard additions.  |
| <b>Sample History</b>                         | 100% assurance that all samples were processed correctly.  |

| Table VIII Software Features            |   |
|---|---|
| Feature                                 | Benefit   |
| <b>Traceability</b>                     | Logging of instrument analytical processes, as well as any modifications to methods or schedules. This provides confidence in the integrity of the final data.  |
| <b>Full Diagnostics</b>                 | Diagnostic features that “add value” to the user including Leak Checking, Diagnostics, and Benchmark Test. Automated Leak Check helps diagnose the leak source. Benchmark Test checks entire system for performance, including electrical, pneumatic and mechanical components. |
| <b>Touch Screen Compatibility</b>       | Lumin and Atomx XYZ TekLink software are touch-screen compatible and allow method building, schedule creation, and diagnostics tasks.   |
| <b>Simple USB Connection</b>            | Simple installation and instrument configuration.   |
| <b>Localization (Language Settings)</b> | Language settings allow the software interface to change to the native language of country in which it is being used. Localized manuals and Help are currently in development.  |

## Account Targeting

### Identifying Customers

When identifying customers, consider who they are, what is their industry, and what are their drivers. Key decision makers include Laboratory Supervisors, Principal Investigators, Laboratory Superintendents, Lead Scientists, Laboratory Managers, Quality Control Managers, Procurement Managers and Project Managers. P&T instrument end users are often Students, Process Technicians and Laboratory Technicians. Customers can be found within a vast array of markets and industries, including:

- Organic Analytical Scientists
- Researchers and Technicians in Chemical, Environmental, Petrochemical, Food, Pharmaceutical, Renewable Energy, and Toxicology
- Environmental
- Research and Teaching
- University, Chemistry, Materials Sciences, Environmental departments
- Food and Drinks manufacturing and testing/regulation
- Water Suppliers
- Wastewater treatment facilities
- Forensics
- Pharmaceuticals
- Petrochemicals
- Industrial Chemicals

## Customer Requirements

Before recommending a Teledyne Tekmar P&T product, identify the customer's specific requirements:

- **Which VOCs are to be detected?** This response will determine the type of system required.
- **What are the expected concentration levels?** This will have an influence on the type of VOC system required.
- **What is the expected sample matrix, including known interferences?** Again, the type of system may be decided at this stage.
- **What is the expected number of samples?** This will help decide if an autosampler will be needed. Will the customer be making sufficient injections? Even if a small number of samples are required, autosamplers provide the maximum injection precision.
- **What EPA methodologies will they be running, if any?** Determines the system, as well as any required options. Vial chilling is a good example.
- **With what GC or GC/MS will the P&T instrument be interfacing?** This information is required in order to supply the proper GC communication cable.
- **Will they be using a GC workstation PC?** If not, also quote a standalone PC, offered by Teledyne Tekmar and suitable for instrument operation.
- **What, if any, P&T instrument are they currently using and what do they like/dislike about it?** Teledyne Tekmar offers multiple configurations and accessories to match the customer's preferences.
- **Approximate anticipated date of purchase.** The date of purchase may have an effect on the type of pricing which you are able to offer.

## Key Selling Messages

Use these selling messages to appeal directly to the unique needs of each customer:

- The instruments are designed to be easy to use, reliable and rugged while maintaining the appropriate accuracy and precision required in the laboratory.
- High specifications include ultra-low carryover and superior water management.
- Combining the P&T and a multi-matrix autosampler into a single platform (Atomx XYZ) means:
  - Lower cost of ownership
  - Faster sample processing
  - Simplified user maintenance
  - Reliability and longevity of use
  - Instrument continuity and stability under one manufacturer
  - Excellent customer care, service and support



Again, in addition to their technical benefits, Tekmar instrumentation can be sold on the following basis:

- P&T market leader
- Over 40 years of P&T experience
- Full applications support on all products and a majority of the GC/MS manufacturers, as well. Our in-house laboratory tests our instruments with Agilent, Thermo Fisher and Perkin Elmer GC/MS.
- Outstanding Technical Support and Field Service.
- Used the USEPA on new method development

## Warranty

The 1-year warranty on all Teledyne Tekmar manufactured models, begins from the date of original shipment. The warranty does not include any consumables.

## Teledyne Tekmar P&T Marketing Contact

**Teledyne Tekmar P&T products are founded on an extensive history of working with the P&T technique and a design philosophy to combine time-tested technologies with cutting edge improvements. Remember, if you should have any application queries, specific quotation request, problems or questions, we are here and are always available to help!**

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