The Orsat AutoGC System

fully automated, round-the-clock, PAMS VOC monitoring using the PerkinElmer Ozone Precursor System

The Orsat AutoGC System has been developed to enhance the analysis of VOC Ozone Precursors. The system is based on a laboratory quality analytical system using cryogen-free concentration and gas chromatography. Composed of a custom integration of the PerkinElmer Ozone Precursor system with the TotalChrom Data System, the Orsat AutoGC software and hardware is designed to automate many of the day-to-day site activities, freeing valuable staff resources for system evaluation and data validation.

Orsat's software creates unique file names for each hourly data file and initiates automatic collection of routine quality control samples necessary to monitor the system performance. Utilizing these easily identifiable file names to automate data archiving and file transfer allows the system to operate with minimal intervention freeing up operator time for data evaluation. It also reduces the time needed to locate specific files and reduce potential data losses. Additionally we optimize the system environment to provide the structure necessary for the automated environment. All installation, configuration, final testing, and third party software products integral to the automation process are included.

CUSTOM SITE CONFIGURATION

Orsat's custom site configuration is designed to automate several aspects of operations on the AutoGC System. In reality, it is a combination several packages. The goal is to relieve the operator of repetitive tasks required to maintain the system on a daily basis.

Included are:

- Merlin MicroScience MPV Dilution System
- Custom TotalChrom Data System Configuration
- Merlin EZ Sequence Software
- Merlin Archiving Software
- Remote Access configurations
- Electronic Logbooks
- Standard Operating Procedures
- Merlin AutoGC Xplorer (optional cloud services)

MERLIN MICROSCIENCE VOC DILUTION SYSTEM

This gas dilution system is a major enhancement to the automated VOC analyzer. It includes hardware to generate humidified air utilizing air from the existing air purifier and compressor. This humidified air is used to generate daily system blanks and the calibration standard diluted for introduction into the PE TurboMatrix Thermal Desorption (TD) system. Calibration samples are generated by dilution of static span gases of 30 ppbv to 10 ppmv concentrations with humidified air using low-flow fixed orifices. This dilution system is capable of dilution ratios of as low as 1:10,000. It is a low volume dilution apparatus with a clearing time of less than five minutes and all wetted parts are constructed of stainless steel.

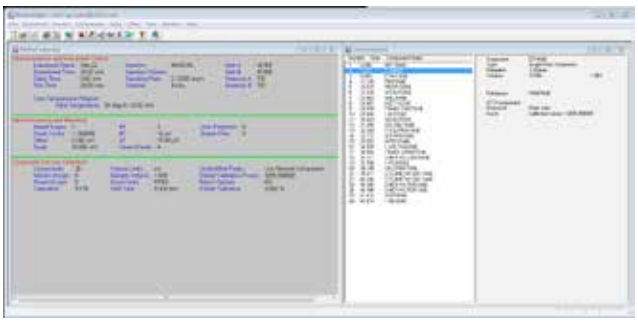
The system has been modified in several ways to incorporate it into the VOC analyzer. By adding electrically actuated solenoid

The MMSD-MPV System is a low volume dilution apparatus with a clearing time of less than five minutes and all wetted parts are constructed of stainless steel that is capable of dilution ratios as low as 1:10,000.

valves we can control the delivery of blanks and check samples via the TotalChrom data system (using timed events). This dilution system reduces errors in long term evaluation of the system performance by allowing the use of a single 33 L canister of a standard at 1 ppmv concentration, which can provide daily calibration checks for periods of up to several months. Using higher pressure cylinders could allow the use of the same standard over the entire season, thus reducing the variability of canister cleaning and refill errors. Additionally, standards used contain only 14 components used as reference peaks for retention time stability as well as propane and benzene used for calculation of system recoveries. At the 100 ppbv to 1 ppmv level these standards are less expensive, more stable and often more accurate than those provided at ppb levels.

TOTALCHROM METHOD FILES

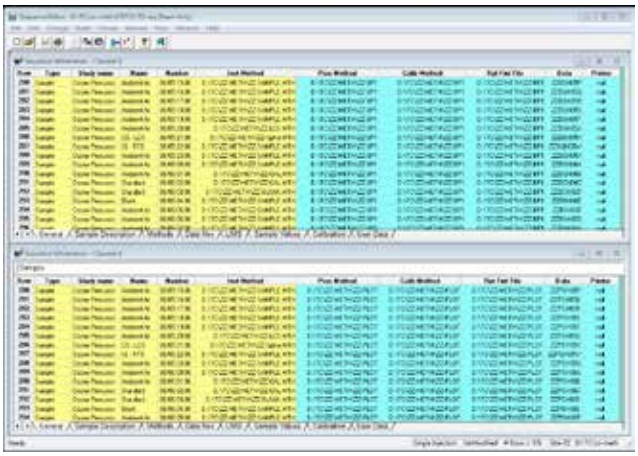
The PerkinElmer TotalChrom Data Acquisition Software relies on two types of method files: Instrument method files and processing method files. Instrument method files control relays configured to automatically control sampling of calibration gases, humidified blanks, and ambient samples. Processing method files contain the component names, retention times, and calibration factors. Processing methods are configured with retention references to ensure accurate component identification where diurnal retention time variations exist.



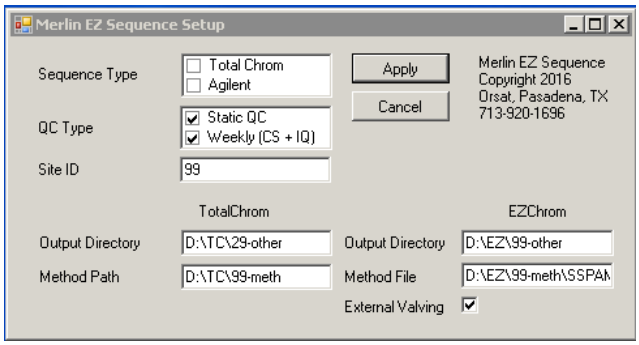
The Totalchrom Method Editor

MERLIN MICROSCIENCE EZ SEQUENCE SOFTWARE

The Merlin EZ Sequence software creates text files for the sequence builder. Sequence files are the instruction set for the gas chromatography data system, and control sampling and method selection for each sample. The sequence automatically assigns unique file names to each hourly data set, and allows the operator to arrange sampling for weeks including the scheduling of blanks, calibration checks, and retention time checks.



The TotalChrom Sequence Editor.



Merlin EZSequence setup dialog.

Unique file names are of particular importance on a continuous analyzer. In a single month of operation the system can generate over 1400 raw data files. The naming scheme for data files includes the site designation, column, sample type (i.e. sample, calibration, blank) and month, day and hour of the day specification. This allows files to be sorted using conventional file handling strategies and to group the files based on some degree of knowledge of their contents. More significantly, by generating these files using a software routine, the operator is relieved of tedious typing chores, the potential for errors is reduced, and valuable time is freed.

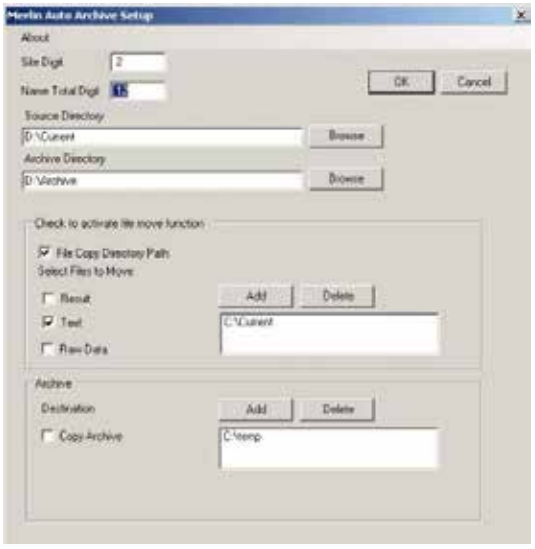
Orsat supplies properly configured and optimized methods for each system according to the specific hardware being used at each site. Instrument method files are integral to the humidified blank and calibration system hardware. With this hardware the system can be scheduled to automatically run calibration blends and humidified blanks each day as well as retention time standards at operator defined intervals.

Blanks and calibration checks are scheduled daily and the operator can choose to have these samples automatically run in the first four hours of each day. Under these conditions the blank and calibration runs occur on hours 00 and 01 or at hours 02 and 03 every other day, thus reducing losses of data for these hours to equal halves. Alternatively, these blanks and calibration checks can be scheduled to occur on a rotational basis throughout the day and night across the monitoring season. This further reduces the loss of data for any given hour to a minimum.

MERLIN MICROSCIENCE MMOVE SOFTWARE

Additional software, Mmove, is provided to automatically compress and archive the data files generated each day. TotalChrom initiates this activity nightly through the method file. Utilizing the date code in the file names, it compresses each day's data files into a "single" compressed file with a unique site and date code name in an archive format (*.zip). The method files and electronic logbooks for the site are included with the data in the daily archive. Automating daily file maintenance frees up operator time to evaluate system performance and validate data, reduce data loss from human error in data handling, and allow for automated file retrieval.

For users of multiple systems, data is archived each hour into a compressed file that can be accessed anytime. Additional configurations are available to automate hourly transfer of data from multiple sites to a main host.



Mmove archiving setup

REMOTE ACCESS SOFTWARE

Remote control is possible for real-time inspection of the gas chromatographic data system via broadband connections. The daily compressed files can be automatically transferred to a remote computer without operator intervention each day or data files can be transferred hourly to a local host for immediate review or display.

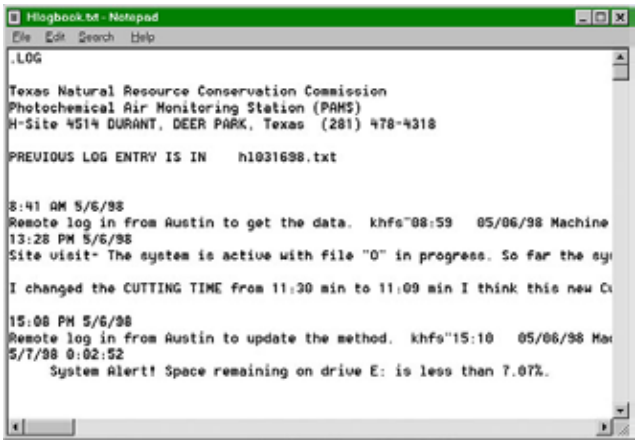
ELECTRONIC LOGBOOKS

Using standard Windows features an electronic logbook can be configured for each site data acquisition computer. The logbook is crucial to efficient operation and validation of daily data. All site activities are recorded in the logbook to allow review of activities which may affect data quality.

These include:

- method changes
- changes in calibration standards
- instrument failures and corrective actions
- site visits for audits
- electronic visits via remote access
- changes in computer configurations
- disk and file maintenance and all repair activities

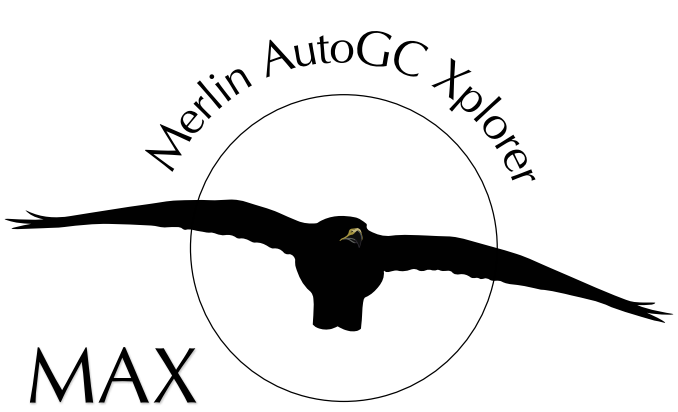
In short, anything that occurs at the site may effect data validation and must be recorded in the logbook. The electronic logbook is archived on a nightly basis to insure integrity and allow data validators immediate access to important information regarding site specific activities which could affect data acquisition.



Site logbooks used to record daily activities at field sites.

STANDARD OPERATING PROCEDURES

These documents are designed to aid the new user through a number of the standard daily operations they will be expected to accomplish at the site. Appendices contain a number of documents and details about all subsystems. Several common trouble shooting problems with their resolutions are included for reference.



MERLIN AUTOGC XPLORER (MAX) CLOUD DATA MANAGEMENT SERVICE

TotalChrom methods can be configured to output text files, which can be imported to many database formats. Orsat can provide cloud services, which allow the operators or managers to view an entire day's data in tabular format using these text files. Users can poll their site once each day and collect the archived data which can then be uploaded into MAX via our secure internet site. MAX generates a daily QuickLook which not only shows the data collected but also calculates recoveries for check standards. MAX allows the generation of control charts of check standard recoveries and blanks over days, months or even years. This allows operators to catch system problems quickly, which might impact data, validation and greatly reduces the need for reprocessing of data.

Orsat field technicians are on hand 24/7 to respond to site needs and perform regular maintenance.

INITIAL SITE SETUP

INSTALLATION AND CUSTOM SET-UP

Orsat can install and configure your entire Ozone Precursor System from its manufacturer packaging. The entire process takes only 3–5 days with all the necessary gases and power requirements available. We recommend each site have an internet connection for remote access and data transfer. In addition, based on our experience with the power requirements of the system, Orsat recommends at least two separate 30 amp circuits be available for the gas chromatograph and thermal desorber. Separate 20 amp circuits should be provided for all ancillary equipment. Air conditioning and other heavy equipment should be well grounded and isolated from the system to reduce line noise, which can adversely affect the electrometer signals. Other recommendations can be found in the Orsat Site Implementation Recommendations.

Orsat offers additional Field Qualification for verification of system performance. This includes calibration and operation of up to one week to prove performance to specifications. See Preliminary Field Qualification data sheet for details on performance specification. Field Qualification is subject to availability of appropriate standards.

Custom installation and configuration provides each field site with a complete monitoring system, which can be configured and tested as a complete system. Software from several sources and hardware from multiple vendors can all be integrated into an effective system from the initial installation. Miscellaneous site-specific problems can be effectively managed from the onset providing a problem free monitoring site.

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