

Ozone Precursor System Support Services

Background

Merlin MicroScience specializes in trace detection techniques. The main focus of our business is in the environmental air and electronic gas industries where PPB (parts per billion) level gas analysis is routine. Merlin is located in Houston, Texas. We are an innovative company comprised of professionals from the analytical laboratory and total over 75 years of experience. Merlin has been in business for over five years. Our dedication to quality products has earned the respect of demanding customers like the State of Texas TNRCC, the Georgia Department of Natural Resources, Motorola, Texas Instruments, Intel and Air Liquide America.

Ozone Precursor Continuous Monitoring Systems

Merlin has been involved with the implementation of the Perkin-Elmer Ozone Precursor System since its earliest implementation in the State of Texas Coastal Oxidant Assessment for Southeast Texas (COAST) program in 1994. Merlin's services encompass all aspects of the site operation. We provide operator training and application assistance covering topics from Microsoft Windows operation to Gas Chromatographic theory. Merlin has customized the installation of hardware and software configured and optimized to operate co-operatively in the Windows environment and produce a robust application capable of continuous unattended field operation. We provide the user with certification data which details the individual system performance at the time of start-up including background, detection limits, precision and linearity. Once configured for robust operation in this fashion, data recoveries are routinely 90 - 95%.

The Merlin Ozone Precursor Application has been developed to enhance the analysis of VOC Ozone Precursors. The basis for our application is the Perkin-Elmer Continuous VOC Analyzer System. Comprised of a custom blending of the P-E hardware, PE Nelson (Turbochrom) Software and Merlin Automation Software and hardware, this application is designed to automate many of the day to day site activities, freeing valuable staff resources for system evaluation and data validation.

Merlins' software creates unique (dos) file names for each hourly data file. Utilizing these names to automate data archiving and file transfer allow the system to operate with minimal intervention freeing up operator time for data evaluation. It also provides uniquely identifiable file names to reduce the time needed to locate specific files and reduce potential data losses. Additionally we optimize the DOS system files and the directory tree to provide 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 and Automation

Merlin's Site Configuration is designed to automate several aspects of operations on the Perkin-Elmer Continuous Ozone Precursor 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;

- ◆ Turbochrom Method Files
- ◆ Merlin EZ Sequence Software
- ◆ Merlin Sequence Archiving Software
- ◆ Norton Navigator software
- ◆ PCAnywhere Remote Access Software

- ◆ Electronic Logbooks
- ◆ Standard Operating Procedures
- ◆ Merlin EZ QuickLook Software

Turbochrom Method Files

The PE Nelson Turbochrom Data Acquisition Software is configured to allow the usage of two types of method files. Instrument Method files are used to control relays configured to control sampling of calibration gases, humidified blanks and ambient air samples automatically (Figure 1). Processing Method files are used to control the data reduction, containing the component names, retention times and calibration factors.

Merlin supplies configured instrument and processing methods for each system and optimizes them according to the specific hardware being used at a given site. Instrument Method files are integral to the Humidified Blank and Calibration system hardware (see below). 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.

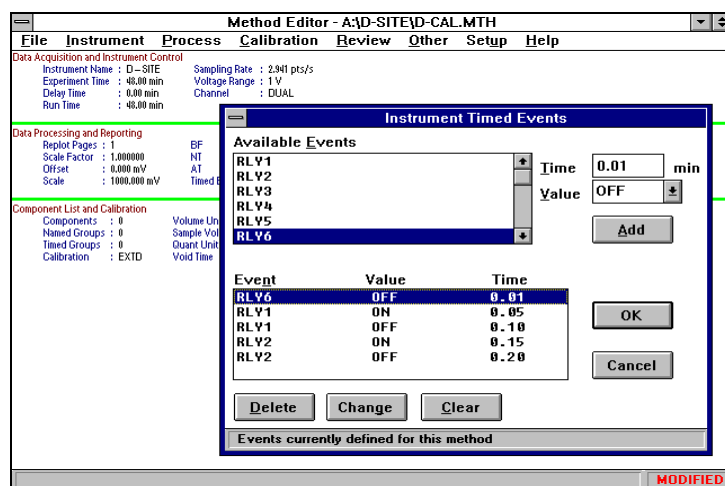


Fig. 1: The Turbochrom Method Editor - showing the timed events necessary to collect a continuing calibration standard.

Merlin EZ Sequence Software

The Merlin EZ Sequence software generates text files that can be imported into the Turbochrom sequence builder. The Sequence files are the instruction set for the gas chromatography data system. They dictate the instrument and processing method to be used for each sample and assign all hourly data unique (DOS) file names. The Sequence allows the operator to configure sampling for two weeks, generating not only unique hourly file names but also scheduling blanks, calibrations, retention time checks and daily archiving of data.

Unique file names are of particular importance on a continuous analyzer. In a single month of operation the system will generate over 1400 raw data files. Merlin's naming scheme for data files includes the site designation, column and 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 we relieve the operator from tedious typing chores, reduce the potential for errors and free up valuable time.

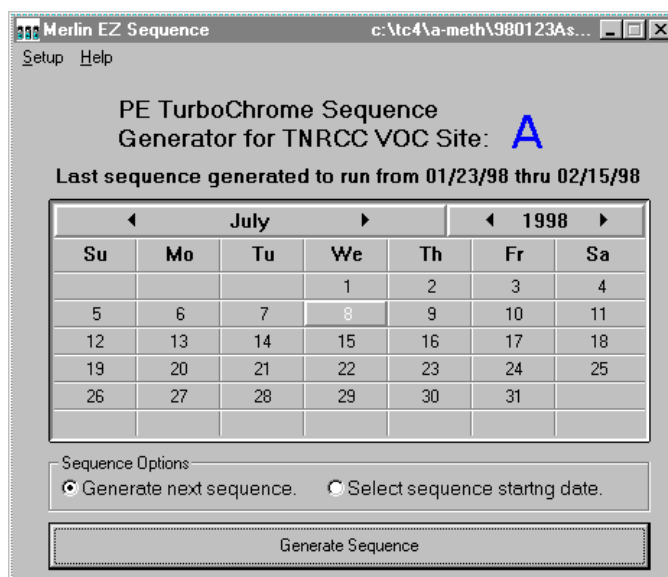


Fig. 2: Merlin EZ Sequence Software

Blank and Calibrations 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 one and two or at hours three and four every other day, thus reducing losses of data for these hours to equal halves. Alternatively, these blanks and calibration runs can be scheduled to occur on a rotationally basis throughout the day and night across the monitoring season. This further reduces the loss of data for any given hour to a minimum.

Row	Type	Study	Name	Samp #	Inst	Proc	Calib	Data	Out
1	Sample	Ozone Prec	Standard	01/01 00:00	C:\TC4\VA	A-PL0T	A-PL0T	APCA01A	nul:
2	Sample	Ozone Prec	Blank	01/01 01:00	C:\TC4\VA	A-PL0T	A-PL0T	APBA01B	nul:
3	Sample	Ozone Prec	Ambient Ai	01/01 02:00	C:\TC4\VA	A-PL0T	A-PL0T	APSA01C	nul:
4	Sample	Ozone Prec	Ambient Ai	01/01 03:00	C:\TC4\VA	A-PL0T	A-PL0T	APSA01D	nul:
5	Sample	Ozone Prec	Ambient Ai	01/01 04:00	C:\TC4\VA	A-PL0T	A-PL0T	APSA01E	nul:
6	Sample	Ozone Prec	Ambient Ai	01/01 05:00	C:\TC4\VA	A-PL0T	A-PL0T	APSA01F	nul:
7	Sample	Ozone Prec	Ambient Ai	01/01 06:00	C:\TC4\VA	A-PL0T	A-PL0T	APSA01G	nul:
8	Sample	Ozone Prec	Ambient Ai	01/01 07:00	C:\TC4\VA	A-PL0T	A-PL0T	APSA01H	nul:
9	Sample	Ozone Prec	Ambient Ai	01/01 08:00	C:\TC4\VA	A-PL0T	A-PL0T	APSA01I	nul:
10	Sample	Ozone Prec	Ambient Ai	01/01 09:00	C:\TC4\VA	A-PL0T	A-PL0T	APSA01J	nul:
11	Sample	Ozone Prec	Ambient Ai	01/01 10:00	C:\TC4\VA	A-PL0T	A-PL0T	APSA01K	nul:
12	Sample	Ozone Prec	Ambient Ai	01/01 11:00	C:\TC4\VA	A-PL0T	A-PL0T	APSA01L	nul:
13	Sample	Ozone Prec	Ambient Ai	01/01 12:00	C:\TC4\VA	A-PL0T	A-PL0T	APSA01M	nul:
14	Sample	Ozone Prec	Ambient Ai	01/01 13:00	C:\TC4\VA	A-PL0T	A-PL0T	APSA01N	nul:

Single Injection # Rows = 576

Unmodified C:\TC4\VA-METH

Fig. 3: The Turbochrom Sequence generated from EZ Sequence text file

Merlin Archiving Software

Additional software is provided to automatically compress and archive the data files generated each day. Turbochrom initiates this activity nightly through the sequence 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 a PKZip 2.0 format. The method files and electronic logbooks for the site are also archived with the data for ease of QA evaluation. Through automating daily file maintenance we free up operator time to evaluate system performance and for data validation and reduce potential data losses from data handling.

For users who have multiple systems and desire more 'real-time' access to data, Merlin can provide an alternative system, which archives the data each hour into a compressed file, that can be accessed anytime. Merlin can provide additional configurations that will allow hourly transfer of data from multiple sites to a main host.

Norton Navigator and PCAnywhere Software

Norton Navigator is supplied for its extended file management capabilities, allowing the operators to view the contents of compressed files and its advanced sort and view macros. Automated file transmission to a centrally located reprocessing computer system is possible on a daily basis via modem using PC Anywhere. In addition, remote control is possible, for real-time inspection of the gas chromatographic data system via modem. 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 advanced ozone prediction systems.

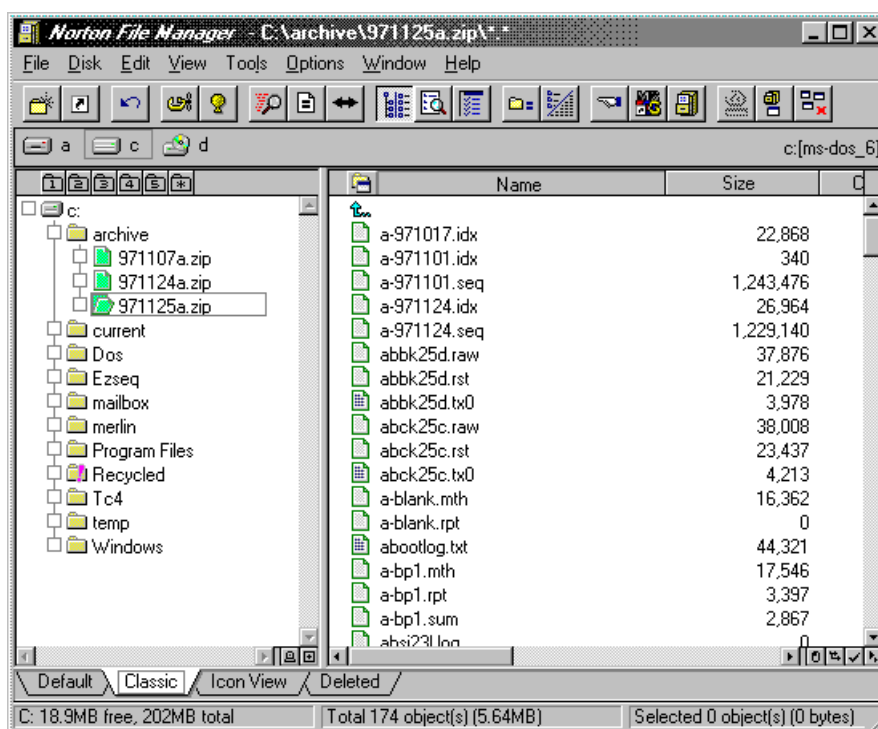


Fig. 4: Norton Navigator Filemanager for viewing contents of compressed files

Electronic Logbooks

Using standard Windows features several electronic logbooks are installed at each site data acquisition computer. These logbooks are crucial to efficient operation and validation of daily data. All site activities are recorded in these logbooks. These include:

- ◆ method changes
- ◆ new calibration standards
- ◆ instrument failures and corrective actions
- ◆ site visits for audits
- ◆ electronic visits via modem
- ◆ changes in computer configurations
- ◆ disk and file maintenance activities

In short, anything that occurs at the site may effect data validation and must be recorded in the logbooks. Electronic logbooks are 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. They are setup for general site activities, method modification, calibration and computer reboot. They are directly available through user friendly icons and a site program group in the Windows program manager.

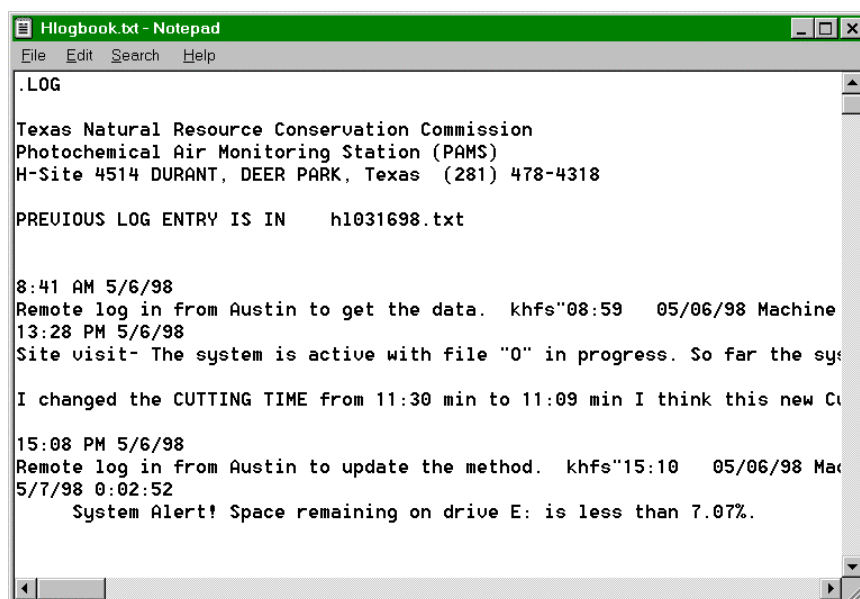


Fig 5: Site Logbooks used to record daily activities at Field Sites

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 non Perkin-Elmer manufactured subsystems. Several common trouble shooting problems with their resolutions are included for reference.

Merlin EZ QuickLook Software

Turbochrom methods can be configured to output text files, which can be imported to many database formats. Merlin provides software, which allows the operator to view an entire day's data in tabular format using these text files. Graphic representation is possible for a single component across 24 hours or a tabular representation of all components by hour is possible. Calibration data is displayed with recoveries and total NMHC value for blanks to validate the day's data. This allows operators to catch system problems quickly, which might impact data, validation and greatly reduces the need for reprocessing of data.

Note: All software is compatible with and requires Windows 95, PCAnywhere 8.0 and Turbochrom 4.2.

Ozone Precursor Humidified Blank/Calibration System

This gas blending system is a major enhancement to the automated VOC analyzer. It includes hardware to generate humidified air utilizing air from the existing Whatman TOC air purifier and compressor. This humidified air is used to generate daily system blanks and the calibration standard blend for introduction into the ATD-400 system. Calibration samples are generated by dilution of static span gases of 30ppb to 10ppm concentrations with humidified air using a micro gas blender. This digital electronic dilution system (Trace Analytical, Inc., Menlo Park, CA) is capable of blend ratios of as much as 1:10,000. It is a low volume blend apparatus with a clearing time of less than 5 minutes and all wetted parts are constructed of stainless steel.

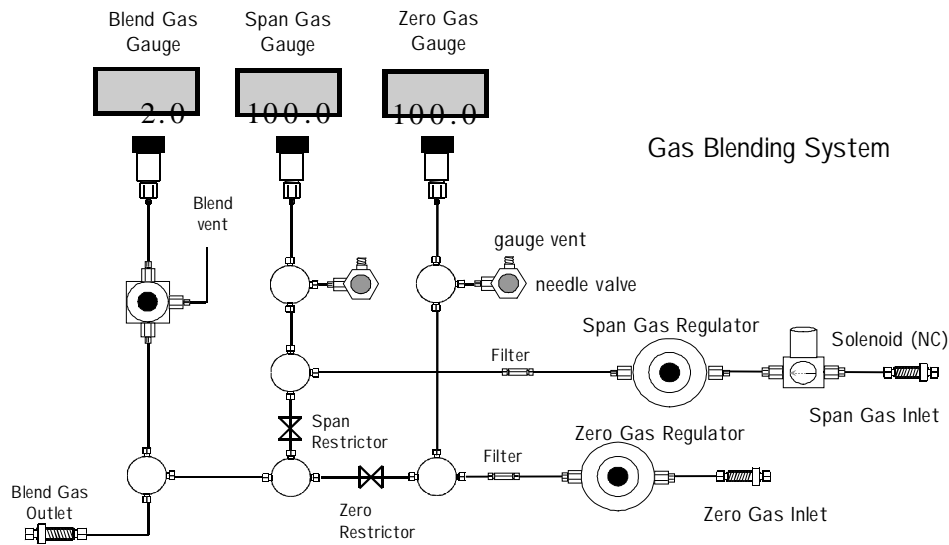


Fig. 6: Automatic Calibration and Humidified Blank Dilution system

The system has been modified in several ways to incorporate it into the VOC analyzer. By adding pressure regulators and electrically actuated solenoid valves we can control the delivery of blanks and standard via the Turbochrom data system (using timed events). A humidifier has been installed for the dry air and a humidity probe block is installed downstream of the wetted flowpath to allow the monitoring of humidity for quality audits and initial set-up. A humidity probe and meter are available options if they are not currently available at the site.

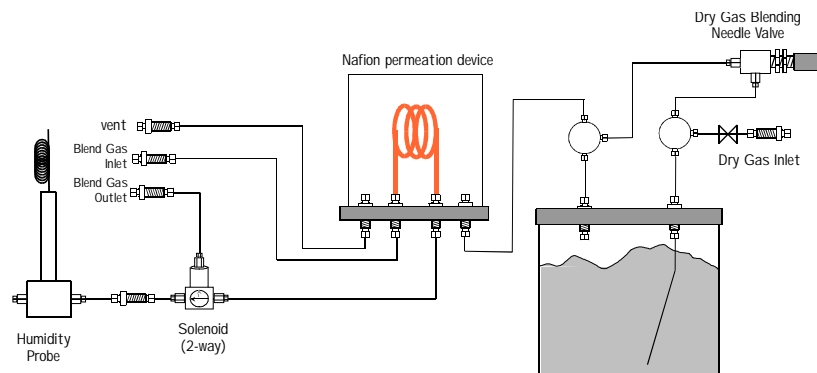


Fig. 7: Calibration and Blank Humidifier

This blending system reduces errors in long term evaluation of the system performance by allowing the use of a single 30L canister of a standard at 1 ppmv concentration, which can provide daily calibrations 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 10-12 components used as reference peaks for retention time stability as well as Propane and Benzene used for calculation of system recoveries. At the 1-10 ppm level these standards are less expensive, more stable and often more accurate than those provided at ppb levels.

Merlin Site Services

Installation and Custom Set-up

Merlin can install and configure your entire Ozone Precursor System from its original cartons. The entire process takes only 3-5 days with all the necessary gases and power requirements available. We recommend each site have two phone lines available for voice and modem connections for the standard installation or 3 phone lines if hourly data will be transmitted. For systems requiring hourly transmission, Merlin provides a second communications terminal. This isolates transmission activities from the system computer and reduces the potential for data losses due to transmission problems on the communications terminal.

In addition, based on our experience with the power requirements of the system, Merlin recommends at least 2 separate 25 amp circuits be available for the Gas Chromatograph and ATD. Separate 10 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.

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.

Preliminary Qualification

Merlin will qualify each system for detection limits, separation efficiency, method optimization as well as response factors and humidified blank criteria. Guidelines used by Merlin for this qualification are accepted by EPA standards and are provided in our Quality Assurance Plan. A written certification is provided with each system for future reference that outlines all standards used, operational parameters and retention time road maps.

Merlin will provide daily standards to be used with the blending system, which are certified and will last the duration of the operating season. Daily standards contain certified concentrations of Propane and Benzene for recovery calculations and up to 12 additional constituents used as reference peaks in the processing methods for the system. Additional EPA 56 component retention time standards and audit samples should be supplied by the customer at the time of installation to be incorporated into the certification document.

System Qualification offers users a comprehensive evaluation of the monitoring system from the onset of its deployment into a field setting. This data can provide operators with concise and detailed documentation by which they can evaluate the system's subsequent performance. It also provides a standard, which can be used in the event of a system failure to guide operators and maintenance personnel in their efforts to return the system to a similar level of performance.

Operator Training

Merlin staff can provide on-site training for all operators on their Ozone Precursor systems. In conjunction with the operating procedures supplied with each system, operators will have a good working knowledge of the system and procedures in place for successful data collection on a continuous basis. In conjunction with the Quality Assurance Plan, each operator will be capable of evaluating the day-to-day performance of the system and implement changes necessary to maintain precise and accurate data throughout the measurement period.

In addition to training on the general operation and day to day data collection, training in routine maintenance of the system such as trap replacement, column conditioning and valve maintenance is included. Troubleshooting techniques such as leak testing and methods for the evaluation of system contamination can offer operators valuable information in the event problems arise. Additional training can be supplied on more general topics such as Window95, Gas Chromatography or the Turbochrom data system.

Maintenance Contracts

Merlin offers yearly service contracts for agencies with multiple systems, which includes troubleshooting, repair and yearly preventative maintenance for each system in the field. Merlin can provide technical support for site operators in their day to day activities and technical evaluations of problems via modem connection. As a partner to you agency's monitoring program, Merlin can help insure that your systems give the highest level of data return and minimize data reprocessing.