

# COMBI PAL

## Front End Automation for Gaschromatography



# Gaschromatography

Environmental

Foods/Beverages/  
Consumer Products

Forensics

Petrochemicals/  
Polymers

Pharmaceuticals



Static Headspace, Liquid Injection and SPME (Solid Phase Micro Extraction) combined in one instrument



Top mounted on GC's, saves valuable bench space



Syringe only concept for transparent sample operation, no sample loops, transfer lines, or switching valves



Interfaces with any major GC/GC-MS system



Remote control software for customized prep and load cycles



## ...the liquid mode

CTC Analytics aim is to supply instruments to customers which make the operation of sample processing simple and transparent. In line with today's laboratory equipment requirements for speed, flexibility and precision. We have enhanced the already proven reliability and productivity of our GC Headspace and Liquid Injection Systems. The Combi PAL is designed to meet these requirements. It is the only GC sample injection system that combines liquid, large volume, headspace and SPME injection in one single instrument. This unique capability allows quick switching from one application to another on the same GC workstation. Regardless if your samples may be processed in headspace, liquid or SPME mode, or if your method requires split/splitless or on column injection, your new instrument setup is ready in a few minutes. The Combi PAL provides powerful working capabilities, an investment you can grow with.

In liquid injection mode, every single injection step, e.g. fill/inject speed, pre- and post injection delay times, pre- and post syringe cleaning, variable needle penetration depths, or standard addition is individually controlled through the Combi PAL's advanced software package. LVI (Large Volume Injection) allows to inject samples up to 500µl without the usual degradation in chromatographic performance. Using the capability to inject larger volumes, you can eliminate the need to concentrate a sample through evaporation. This can translate into substantial time savings. For low volume samples the fast injection speed minimizes needle discrimination and reduces background interference which means better results with less rework. The fast injection cycle time together with the nanoliter injection mode fits perfectly into the field of fast GC applications.

### Specifications in liquid mode

#### Syringe sizes:

1.2µl	(0.1µl-1.2µl)
5µl	(0.5µl-5.0µl)
10µl	(1µl - 10µl)
25µl	(2.5µl - 25µl)
100µl	(10µl - 100µl)
250µl	(25µl - 250µl)
500µl	(50µl - 500µl)

#### Injection speed:

Selectable from 0.01µl/sec. up to 250µl/sec.

#### Sample capacity:

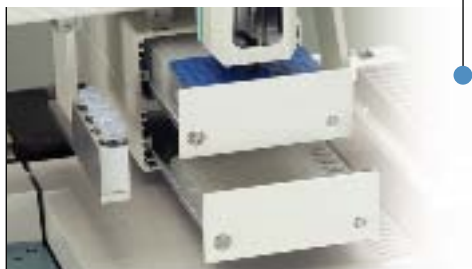
up to	600	1ml micro vials
	294	2ml standard vials
	96	10ml or 20ml vials
	4	deepwell microplates
	6	standard microplates

#### Syringe cleaning:

Wash Station for 2 different solvents



Choose from a wide variety of syringe sizes



Be prepared for the next generation of sample format



Barcode reading ensuring positive sample identification



## ...the headspace mode

With the syringe only concept of the CombiPAL a headspace technology has been introduced to eliminate the headaches commonly associated with conventional autosamplers. The robotic vial processing operation allows sample analysis in a straightforward and simple way. Sample vials are transported into the heated six position incubator for preconditioning. After reaching the equilibration, a heated gas-tight syringe is moved over the incubator and the headspace sample is withdrawn. After sample injection the hot syringe is automatically cleaned by purging with inert gas. No complicated error prone operations e.g. vial pressurization, valve switching, loop filling or heated transfer lines are involved. For maximum throughput, the intelligently controlled vial transfer into the incubator oven ensures that a sample is always ready to be injected when the previous run is completed.

Beside the simple and transparent sample operation the CombiPAL offers even more advantages over conventional headspace sampling:

- eliminates dead volume and adsorption effect in sample loops and transfer lines
- permits adjustable sample volumes without sample loop changes
- no sample dilution due to vial pressurization



Thermostatted Trayholder for thermo labile samples



The CombiPAL accepts virtually any sample format



SPME Fiber cleaning and conditioning station

### Specifications in headspace mode

#### Syringe sizes:

1.0ml (0.1-1.0ml)  
2.5ml (0.25ml-2.5ml)  
5.0ml (0.5ml-5.0ml)

#### Injection speed:

Selectable from 0.01  $\mu$ l/sec. up to 5ml/sec.

#### Sample capacity:

up to 294 2ml standard vials  
96 10ml or 20ml vials

#### Syringe cleaning:

Inert gas purging of heated syringe

#### Heated syringe:

30°C-150°C selectable in 1°C increments

#### Incubator oven:

6 heated vial positions for 2ml/10ml/20ml vials

#### Incubation temperature:

30°C-200°C in 1°C increments

#### Agitation:

Interval shaking 250rpm-750rpm  
Selectable in 1rpm increments

#### Incubation time:

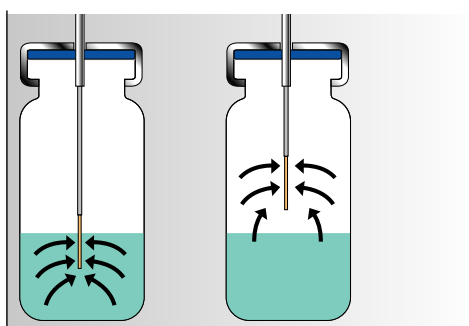
Up to 999 minutes selectable in 1 second increments



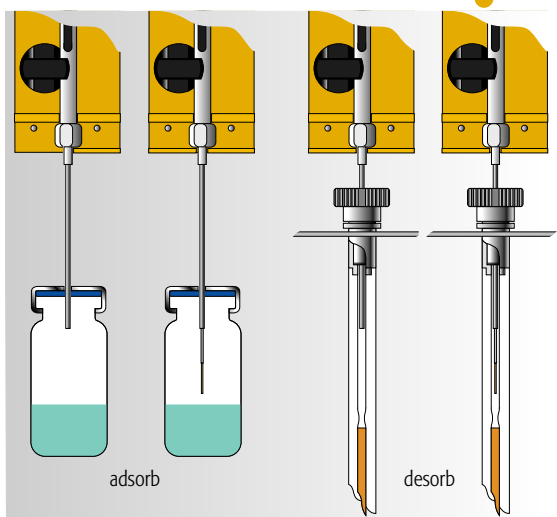
## ...the SPME mode

In the few years since its introduction, solid phase microextraction (SPME) has become established as a practical alternative for sample preparation for gas chromatography. SPME reduces the time required for sample preparation and eliminates the use of large volumes of extraction solvents. In SPME, analytes establish equilibria among the sample matrix, the headspace above the sample, and a stationary phase coated on a fused silica fiber, then are thermally desorbed from the fiber to a capillary GC column. Because no solvent is injected, and the analytes are rapidly desorbed onto the column, minimum detection limits are improved and resolution is maintained. SPME is useful in many different analysis, including characterization of environmental, forensic, food/ flavor and pharmaceutical compounds.

The CombiPAL provides a fully automated SPME sample preparation process\*. All movements of the SPME fiber from precondition, adsorption and desorption are precisely controlled for optimum performance. Prior and during extraction the samples can be shaken and heated, which dramatically reduces analysis time for semivolatiles compounds. Variable vial penetration depth allows to extract the compounds in liquid samples itself or in the headspace area above liquid/solid samples. After the compounds are thermally desorbed in the hot GC injector, the fiber may be fully cleaned again in a special heated and purged Fiber Conditioning Station.



Variable vial penetration for different types of sample extractions



Fiber adsorption / desorption process

### Specifications in SPME mode

SPME fiber holder for standard SPME fibers. Variable vial penetration depth for headspace or liquid extraction. Samples can be agitated and / or heated during extraction

**Sample capacity:**  
 up to 294 2ml standard vials  
 96 10ml or 20ml vials

**Fiber cleaning:**  
 Optional fiber cleaning station  
 30°C-350°C, inert gas purging

**Incubator oven:**  
 6 heated vial positions for 2ml/10ml/20ml vials

**Incubation temperature:**  
 30°C-200°C selectable in 1°C increments

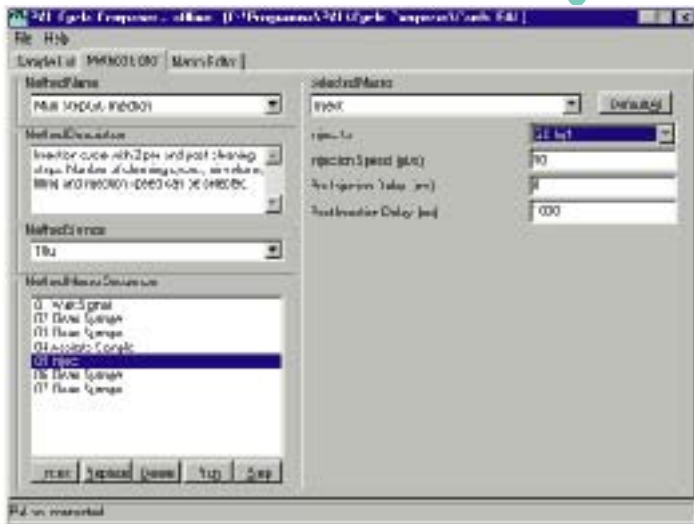
**Agitation:**  
 Interval shaking 250rpm-750rpm  
 Selectable in 1rpm increments prior extraction

**Extraction time:**  
 Up to 999 minutes selectable in 1 second increments

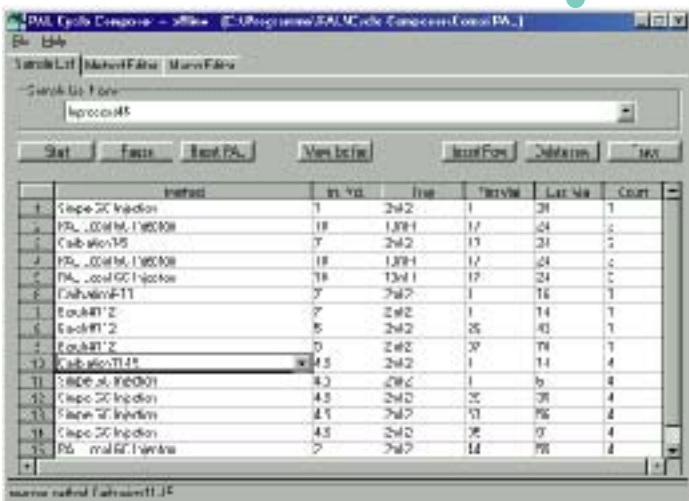
\*Automation of SPME technology licensed from Varian Inc.  
 Solid Phase Microextraction (SPME) Technology licensed exclusively to Supelco Inc.  
 US patent #5,691,206 European patent #0523092



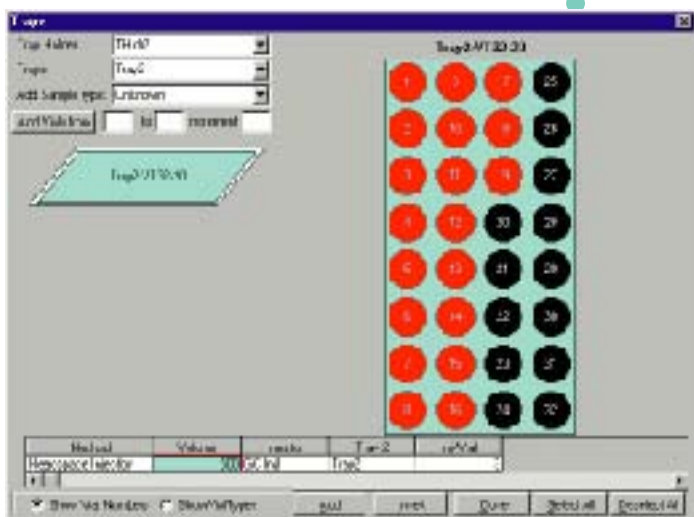
...with software control



Method editor: Setup and edit customized CombiPAL cycles



Sample list: Setup and run injection sequences



Trays: Graphical sample list generator

### Intelligent Automation

The Windows 98/NT4/2000/XP software Cycle Composer provides remote control for the CombiPAL GC Front End liquid handling systems. The Cycle Composer software allows the operator to easily setup, edit and run CombiPAL methods for even very complex Prep and Load applications.

### Easy to use

The Cycle Composer affords complete control over sequence and location of liquid handling steps, thereby increasing throughput and productivity of the CombiPAL System. The point and click operation quickly directs the user through programming steps that configure instrument setup, methods and sample lists. For routine daily use, no special programming skills are needed. The Cycle Composer contains a library of common liquid handling procedures including sample transfer, reagent/standard addition, mixing and dilution steps.

### Customize your CombiPAL

As with the PAL hardware concept the Cycle Composer is already prepared for individual application requirements. Additional flexibility can be assigned to sample prep procedures by using the powerful Cycle Composer macro language, which expands the application range of every CombiPAL System.

### Single keyboard operation

The Cycle Composer can be used as an independent standalone software platform or if required fully integrated in leading GC-MS data acquisition systems. Currently the following control drivers are available either through CTC Analytics or your instrument vendor.

### Third party software PAL GC Version

- Agilent ChemStation
- DataApex Clarity
- Dionex Chromeleon
- Justice Software Chromperfect
- Leco ChromaTOF
- Shimadzu GCMSsolution
- ThermoFinnigan Xcalibur
- Varian Star
- Varian Galaxie
- Waters Masslynx

### Cycle Composer specifications:

#### Minimum PC requirements:

- Pentium III processor >1.0GHz
- 256 MB RAM
- 1 free RS232 serial interface
- 1 CD ROM drive
- installed Windows 98/NT 4 / 2000 / XP®
- 10 MB free Harddisk space

#### Compatible PAL Instruments:

- CombiPAL, GC PAL
- (including PAL Firmware 2.0 or higher)

# COMBI PAL

## General CombiPAL Specifications:

### System type:

XYZ robot with syringe only concept, no tubing in sample path

### Local user interface:

Control panel with 4 function keys, graphical LCD display, unique scroll knob for teach functions

### Remote control:

Cycle Composer control software Windows 98/NT4/2000/XP®

### Electrical control:

2 RS232C ports,  
3 TTL Input/3 TTL Output,  
2 Opto Coupler Input,  
2 Relay Output

### Dimensions:

L: 828mm D: 385mm H: 648mm

### Weight:

10kg (without accessories)

### GC mounting kits:

Agilent 5890 / 6850 / 6890

ThermoFinnigan Trace 2000 / GC 8000 top

Varian GC 3400 / 3600 / 3800 / 3900

Shimadzu GC 14 / 17 / 2010

Perkin Elmer Autosystem XL / Clarus 500

### Options :

Cooled Trayholders for 1ml/2ml/10ml/20ml vials

Barcode Reader (for common industry standard bar code symbols)

SPME Fiber Cleaning Station

Stacks for 96/384 well micro- or deepwell plates

Solvent/Reagent reservoir

Large Volume Wash Station

Specifications are subject to change without notice

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## ...other PAL sample injection systems

HTS PAL High throughput  
LC-MS sample loader

LC PAL Versatile, small footprint  
LC, LC-MS sample injector



Distributed by:

CTC Analytics has dedicated the last 10 years to the continued development and high reliability of advanced sample injection technology. To learn more about the unique GC injector Combi PAL or any of our LC/LCMS sample injection systems contact your CTC Analytics distributor

... **CTC ANALYTICS**  
Where design meets performance

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