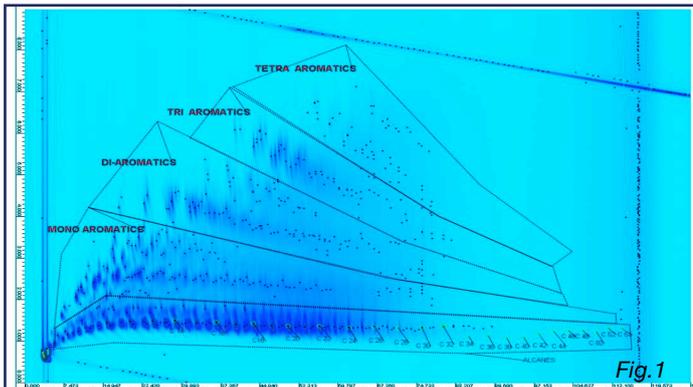


## Intelligent device for optimize your modulation process with Zoex thermal modulators



### The introduction of the NEW SRA Optimode V.2 offers new possibilities for GCxGC:

- Improved accuracy and repeatability of the modulation time
- Multi-modulation management: to adapt the modulation time during the analysis
- Multi-step programming of the cold flow during the GC run
- Intuitive programming web interface and new network (Ethernet) connection
- Automatic Gas Saver Function: for reducing nitrogen cold flow between GC runs (less gas and liquid nitrogen consumption)
- Available for Zoex thermal modulators series ZX1 and ZX2



## Description

The SRA-Optimode is the heart of your bi-dimensional chromatography system, efficiently controls all the thermal process.

The SRA-Optimode controls the cold nitrogen flow and the hot air pulse in the most efficient way.

The SRA Optimode V.2 employs the highest level of integrated electronics for precise temporal control.

The first hot air pulse is initiated within 2 ms after the GC start.

**The modulation period is repeatable at about 12.5 ns.**

The mass flow rate is controlled with 8 bits (0.39% sensitivity), its characteristic response time is less than 1 ms.

The time delay is also extremely small (one to 120,000, or 30 ms/h). In addition to this high performance, the SRA-Optimode supports multi-modulation: hot air jet control parameters are modified during the analysis according to a predefined table, adapted to the product analysis.

The SRA Optimode interface is fully integrated: the device hosts an embedded server. This provides the web pages needed to control parameters. The access requires just a network connection and a Web browser:

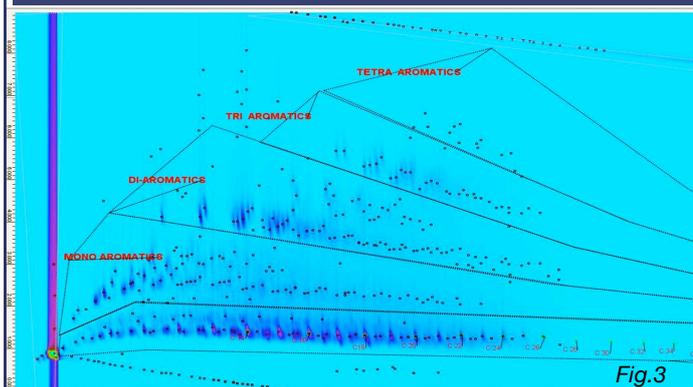
The interface is intuitive, organized into pages each one dedicated to a utilization method (simple modulation, multi-modulation, maintenance, etc.). Each page is divided into 3 parts.

- A notice board showing the interface and the concerned function.
- A real time display section of the menu parameters (on or off hot air jet state, mass flow opening, open or closed state of the starting contact, elapsed time since the beginning of a cycle, etc..)
- A parameter section which allows the system configuration. It is also possible to use the SRA-Optimode when is not connected: with the factory settings, or after web configuration.

Fig.1 GCXGC Image of Vacuum Gas Oil Analysis (courtesy of IRCE Lyon)

Fig.2 GCXGC SRA Optimode V.2 device

Fig.3 GCXGC I Image of SRGO Straight Run Gas Oil analysis (courtesy of IRCE Lyon)



## Principle of operation

Comprehensive two-dimensional gas chromatography employs an interface device, the modulator, between the first and the second column. The thermal modulation uses hot and cold jets of gaseous nitrogen to continuously and efficiently trap and inject portions of eluting peaks from the primary column into the secondary column.

The thermal processes are determined by the nitrogen cold flow and the temperature/time of the hot pulse. In order to obtain an optimal modulation ratio of 3-4, the cold jet flow must be optimized during the GC run for such application that requires the simultaneous determination of either very volatile compounds and high boiling compounds. The optimized combination of these two jet operation improve the efficiency of the modulation in terms of preventing break-through of the high volatility compounds and avoid the trapping for semi-volatile compounds causing increase contribution on the modulation ratio and peak tailing

## Optimode operation

Optimode V.2 improve the efficiency of the modulation in terms of preventing break-through of the high volatility compounds and avoid the trapping for semi-volatile compounds causing increase contribution on the modulation ratio and peak tailing



During a GC run Optimode V.2 controls the activity and the frequency of the hot pulse valve,



and controls the cold jet gas nitrogen flow by a Mass Flow Controller with multi-programmable optimized flow ramp rate. Additionally a Stand-By function set the nitrogen flow rate at a low and safe value to prevent cold jet spot icing and reduce the liquid / gaseous nitrogen consumption between analysis.

For a typical 90 minute hydrocarbons analysis, Optimode save more than 60% of gaseous nitrogen.

**Configuration**

Hot Jet: Modulation (s) 20, Hot Jet (s) 30, MF Check Points 4, Idle Mass Flow: Mass Flow Idle (%) 3

Mass Flow: 00h00m00, 00h15m00, 02h31m00, 00h00m00

Time (s): 0, 900, 9 060, 0

Mass Flow (%): 50, 35, 5, 0

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Fig. 4 SRA Web interface of the Optimode, configuration section.

## Specifications

HOT JET MODULATION	
Modulation and Hot Jet resolution	0,1 $\mu$ s
Modulation and Hot Jet variance	12,5 ns
Modulation and Hot Jet input step	1 ms
Modulation and Hot Jet maximum span	1h40
Number of modulation phases	10
Phase duration	Up to 100 h
Delay on Start contact	2ms $\pm$ 1 ms
MASS FLOW CONTROLLER	
Mass Flow resolution	0,39%
Number of Mass Flow interpolation coordinates	10
Max time between Mass Flow coordinates	5h50
CLOCK	
Internal clock variation	9 ms per hour
DIMENSIONS	
Lenght x Base x Height	230x125x90mm