SRA-Optimode

OPTIMODE 2 - KEY POINTS:

- Advanced GCxGC Modulation : Optimode 2 supports the Multi-modulation period during the GC run.
- Save Nitrogen : With the automatic Mass Flow Control of the N2 cold Jet flow, Optimode optimizes the modulation jet during the run and save the N2 consumption with an automatic idle Low Flow set Point applied between runs.
- Easy control by Ethernet on the GC or GC/MSD network
- No software installation required. Any web browser can control and program the Optimode in few minutes.
- No Hardware modification. Not necessary to open the 7890GC : Connect the Remote to 7890GC and install valve #5 to control the modulation. Compatible with the standard ZOEX modulation Valve.

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Overview.

The Optimode is a device used in 2D chromatography: it controls the gas injection from the first column into the second. The SRA-Optimode manages a cold jet with a mass-flow controller, ensuring chemical adsorption between columns. The desorption occurs periodically via a hot jet pulse. The Mass-Flow and hot jet outputs are showed in the following figure (Figure 1): Hot Jet EV and MFC Cold Jet.

Figure 1 : SRA-Optimode.

The front pannel shows 6 LED indicators, as seen above (Figure 1).

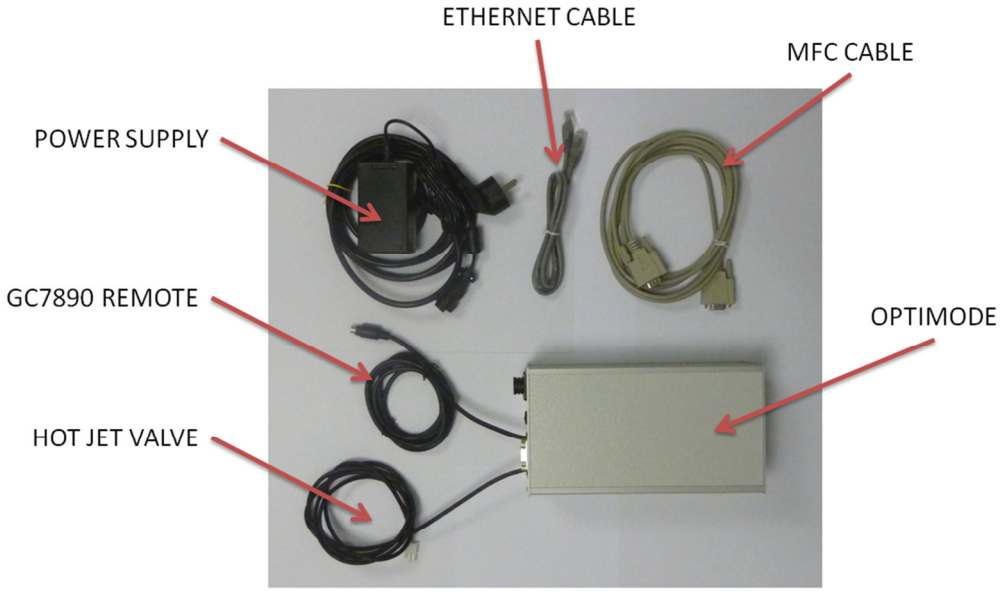
Power is lit if the system is powered-up and functionnal.

Idle, cycle, and special mode are used as reset indicators (see Reset section), and to show if the system is currently running, waiting for instructions, or in configuration.

Start In indicates if the GC start is on. (correspond to Valve #5 on 7890GC)

Hot Jet shows if the hot jet signal is on.

Ship Kit



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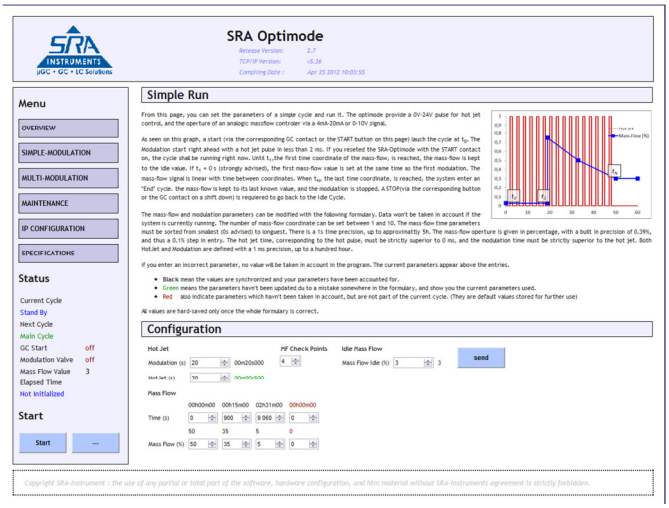

Figure 2 : home page of the web site.

The device hosts an embedded web server. It provides webpages for parameters control. Accessing the interface only require a LAN connection (see Figure 1 (A)) and a web browser (overview Figure 2).
The SRA-Optimode is also used off-line, with factory parameters, or with pre-set parameters (after LAN configuration).

Principle of operation

The Optimode software is a state machine working as presented above (Figure 3).When running (A), it provides the LAN communication, and works according to the different states (B). A reset, initialized by pressing the corresponding button 3 s, at power on, or by asking for IP reconfiguration, is acknowledged by the 3 cycle LED blinking.

Reset

3 types of reset can occur.

If the reset button (Figure 1 (A)) is hold during reset, all settings are reset to factory values. The cycle LED blink successively to indicate success.

If the data memory is corrupted or missing, factory settings are also loaded. This shall not occurs under normal condition. The Idle and special mode LED blink together, in opposition with the active mode LED.

In case of a regular reset, the last parameters saved are restored. The LED blink together quickly.

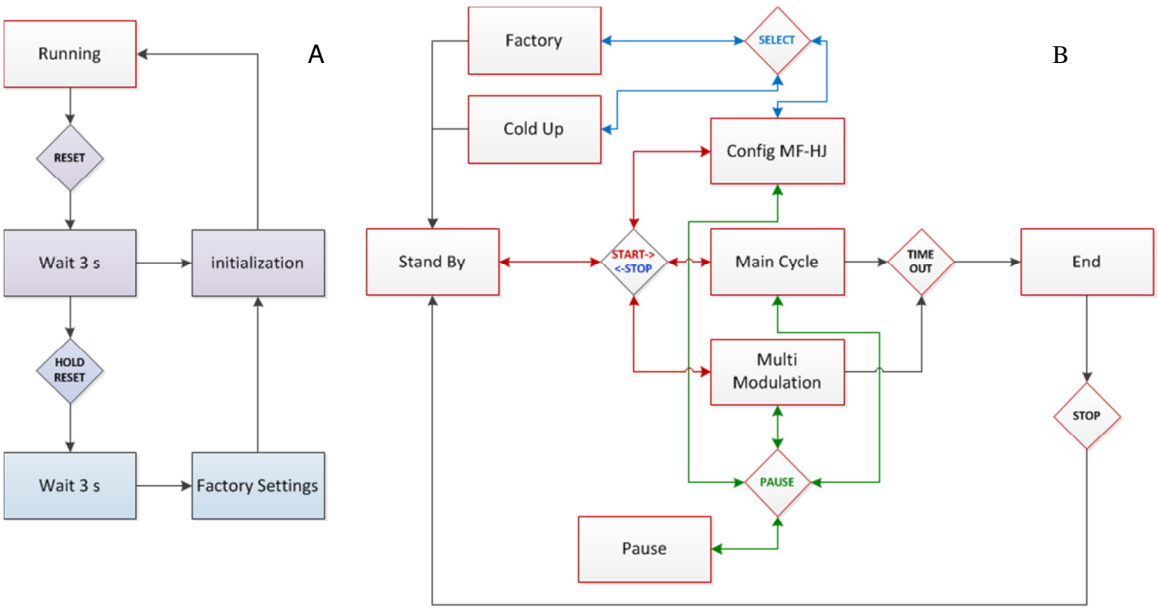

Figure 3 : State Machine principle.

State machine

By default, the optimode is in *Stand By* state. The *start* and *stop* are triggered by the GC contact (respectivelly on an down-to-up or up-to-down front), or by the web interface. The *pause* is only available from the web pages. The software goes to *Main Cycle*, *Special Modulation*, or *Config MF-HJ* depending on the web interface, as explained further.

Stand By is the default idle state of the device. The modulation is off and the mass-flow kept at idle value. The idle Led is lit. Stand By is automatically entered at the reset of the board, if the *"Start"* connector is off (the connector status can be monitored on the "GC Start" status field). An up-to-down front on the GC connector or the *"Stop"* button also engage Stand By mode.

Main Cycle is a simple cycle with fixed modulation and mass-flow control. The Cycle Led is lit during operation. A Main Cycle shift to a *Stand By* mode if a stop (software button of connector) occurs, or to a *"End" phase* at the end of the cycle's duration. The time elapsed since the beginning of the run is diplayed, along with the real time mass-flow value. The hot jet state command can also be monitored in real time.

Multi-modulation is similar to the *Main Cycle*, but enables the multi-modulation. This cycle shall be launched from the proper web page (Multi-Modulation). If *"Special Cycle"* appears in the *Next cycle* field instead of "Main Cycle", reload the current web page with the *"MAIN CYCLE"* link in the navigation bar.

The End Cycle occurs after time out (*Main of Multi*). In this state, the modulation is off, and the mass-flow is kept at the last known value. To exit this state, one must call a stop (software or GC Start down shift), and go to *Stand By* mode. When the system enters the *End Cycle*, a "Press Stop" Message is displayed on the interface.

Pause is a simple state entered with the corresponding software button, putting the device idle and on again. The idle Led is lit during pause. Pause is not available from the *stand-by* state.

Cold Up is a special function available at the beginning of your experiment. Via a brief sequence of hot pulses at 50% mass-flow aperture, the system is awakened and put in optimal conditions. Every hypothetical ice is removed by the hot jet, and the mass-flow arrival is cooled down. The cold up automatically ends in Stand By mode. The "Special Cycle" Led is lit when running. Cold Up is available from the maintenance web page.

Config-MF-HJ is also available from the maintenance page. It lit the Special Led. It enables fine tuning and test of the mass-flow controller and of the hot-jet. This function is used at factory to set the 4 mA - 20 mA output trimmers.

Factory Cycle set the device parameters to their initial value. The IP configuration is not changed in between.

Web page architecture.

The web server is accessible by entering the IP adress or the hostname (if DHCP is supported) of the board in a web browser. (The defaults parameters are joined to the Optimode box) By default, the *simple modulation* page is returned.
As explained below (Figure 4), navigating through the pages can implicitly change the system state (or the system state to be if a cycle is currently running). The Overview and Specifications pages only display informations, and don't change the current cycle. The maintenance page englobe several functions like the cold up and factory recovery. In case of a change in the IP configuration, the system is automatically reset with the new parameters.

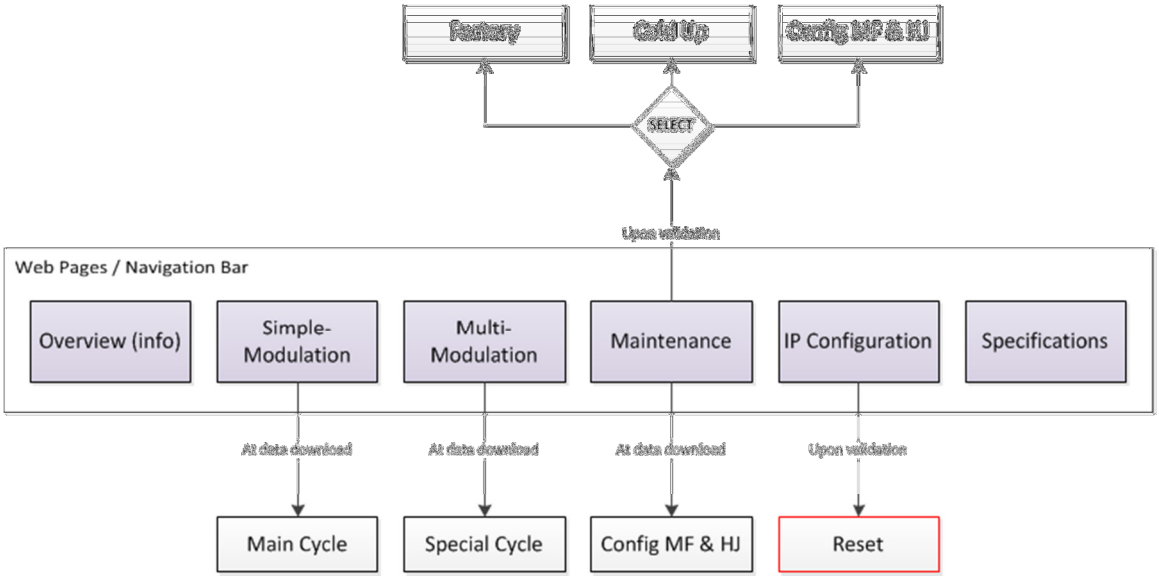

Figure 4 : Web site architecture.

Each page of the web interface is built on the same model (Figure 2). The interface comprises several parts.
The navigation bar (Figure 5 (A)) is on the left side up to the status section (Figure 5 (B)). Information diplayed in the status section concerns the software. The start button is the software equivalent of the GC start. Next to the software start is the pause button, disabled in Stand by.

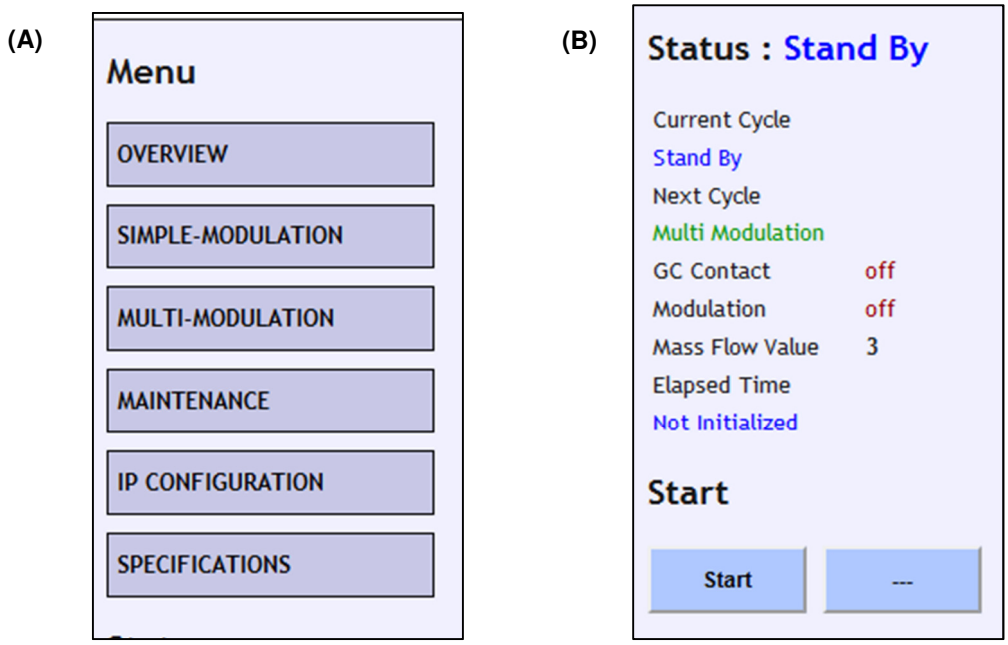

Figure 5 : Side Bar.

The information pannel (Figure 6) provide information on the current page, on the cycle to launch, and on the interface.

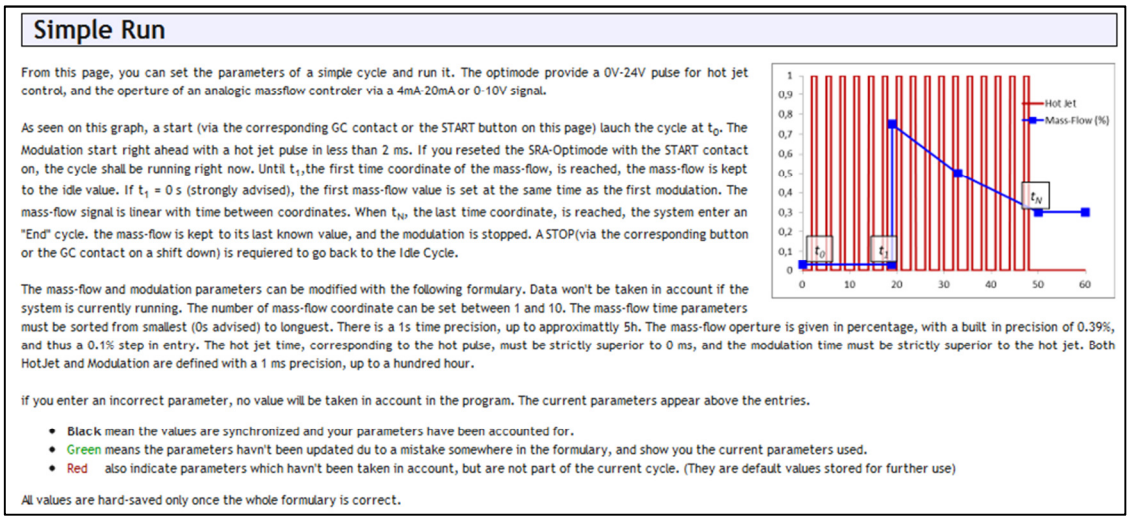

Figure 6 : Description and information section.

The formulary interface enable parameters configuration (Figure 7). The input section is related to the web page displayed. The information is submitted via the *download* ***button***. The parameters are displayed as default value for input and as text indicator. This redundancy is used to convert the entry from seconds to explicit time, and to highlight errors found in the submitted parameters. Text parameters displayed in black are in agreement with the values submitted. Text in green shows the actual value used by the software. Red text is used to show the value displayed is irrelevant.
The parameters are stored on hard memory once and only they are all correct. Parameters can't be changed while the system is running.

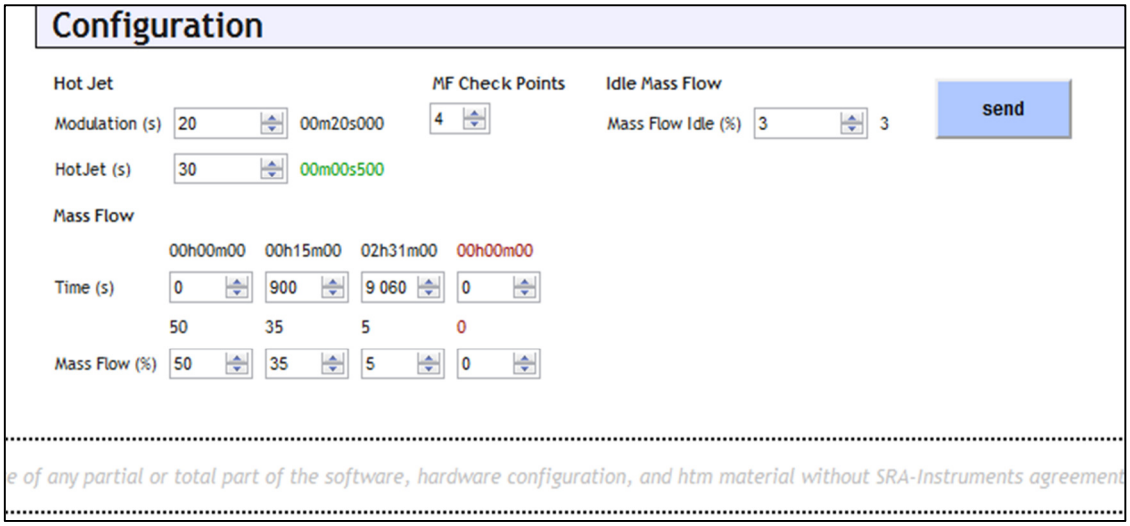

Figure 7 : Configuration section.

In Figure 7, by example, the modulation parameter is correct, but the hot jet isn't (it must be shorter than the modulation). The hot jet used by the software, 0.5s, is displayed in green.
The number of interpolation coordinates for the Mass Flow has just been increased from 3 to 4. The 4th couple of coordinates is in red to show the parameters displayed are irrelevant: while a time parameter superior to 2h31 hasn't been set, only 3 coordinates will be taken in account by the program. Both Hot Jet and Mass Flow parameters must be correct before data is stored on hard memory.

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ANNEXE A : Parameters browsing in the web interface.

Status Section (Common)

Current Cycle (display).
Next Cycle (display).
GC Start (display) On/Off.
Modulation Valve (display) On/Off.
Mass Flow Value (display) 0 to 100%.
Elapsed time (display) only while running.

Start/Stop (submit). Start or stop the "next cycle". No data change during a run.
Pause (submit): stop or continue a run.

Configuration Section.

Main Cycle.

Modulation. : modulation period in simple modulation
Hot Jet : hot pulse Duration.
MF Check Points : number of mass flow interpolation coordinates.
Mass Flow Idle : value of mass flow in stand-by.
Mass Flow Time : time component of the mass flow coordinate.
Mass Flow % : aperture component of the mass flow coordinate.

Multi-Modulation

HJ check points : number of different modulation parameters in multi-modulation.
Modulation (checkbox) : is set if the modulation is disabled during this phase.
Modulation time. : time of modulation beginning with the corresponding parameters. Every modulation started is finished : there can be a difference between the input time and the actual beginning of the modulation.
Modulation : period of the modulation.
Hot Jet : hot jet duration.
MF Check Points : see main cycle.
Mass Flow Time : see main cycle.
Mass Flow % : see main cycle.

Maintenance.

Mass Flow values (4-20mA, 0-10V, bits) (display).
: different corresponding measure of current mass flow command.
Mass Flow Set : temporary value of the mass flow for measurement and adjustment.
Hot Jet Valve Set : temporary state of the hot jet valve (On/Off).
Mass Flow Button : submit the mass flow and hot Jet valve.
Timer Time : duration of an experiment (arbitrary unit)
Timer Shift : time shift to apply on this duration (same arbitrary unit, integers only)
Timer Button : submit the timer shift to apply
Cold Up Button : launch cold up cycle
Hot Jet CheckBox : for memory use: select the modulation parameters for reset.
Mass Flow CheckBox : for memory use: select the mass flow parameters for reset.
Timer CheckBox : for memory use: select the clock definition of 1 ms for reset.
Idle MF CheckBox : for memory use: select the idle Mass Flow level parameters for reset.

Factory button : reset parameters to factory settings.

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Defaut IP Config.

Host Name : SRAOPTI-XXXX (XXXX= Serial Number)
IP Address : **10.1.1.111**
Gateway : 10.1.1.1
Subnet Mask : 255.255.255.0
Primary DNS
Secondary DNS
Enable DHCP : enable the auto-attribution of an IP address from a DHCP server.
Enable Auto-IP : enable the board to change IP itself in case of conflict.

ANNEXE B: Specifications.

Hot Jet Modulation	
Modulation and Hot Jet resolution	0.1 µs
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	2 ms ± 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	230 mm x 125 mm x 90 mm

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